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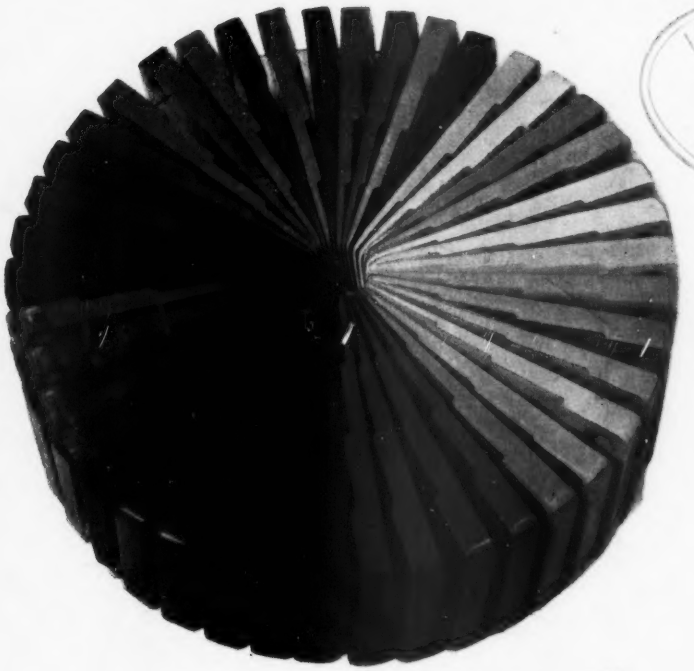

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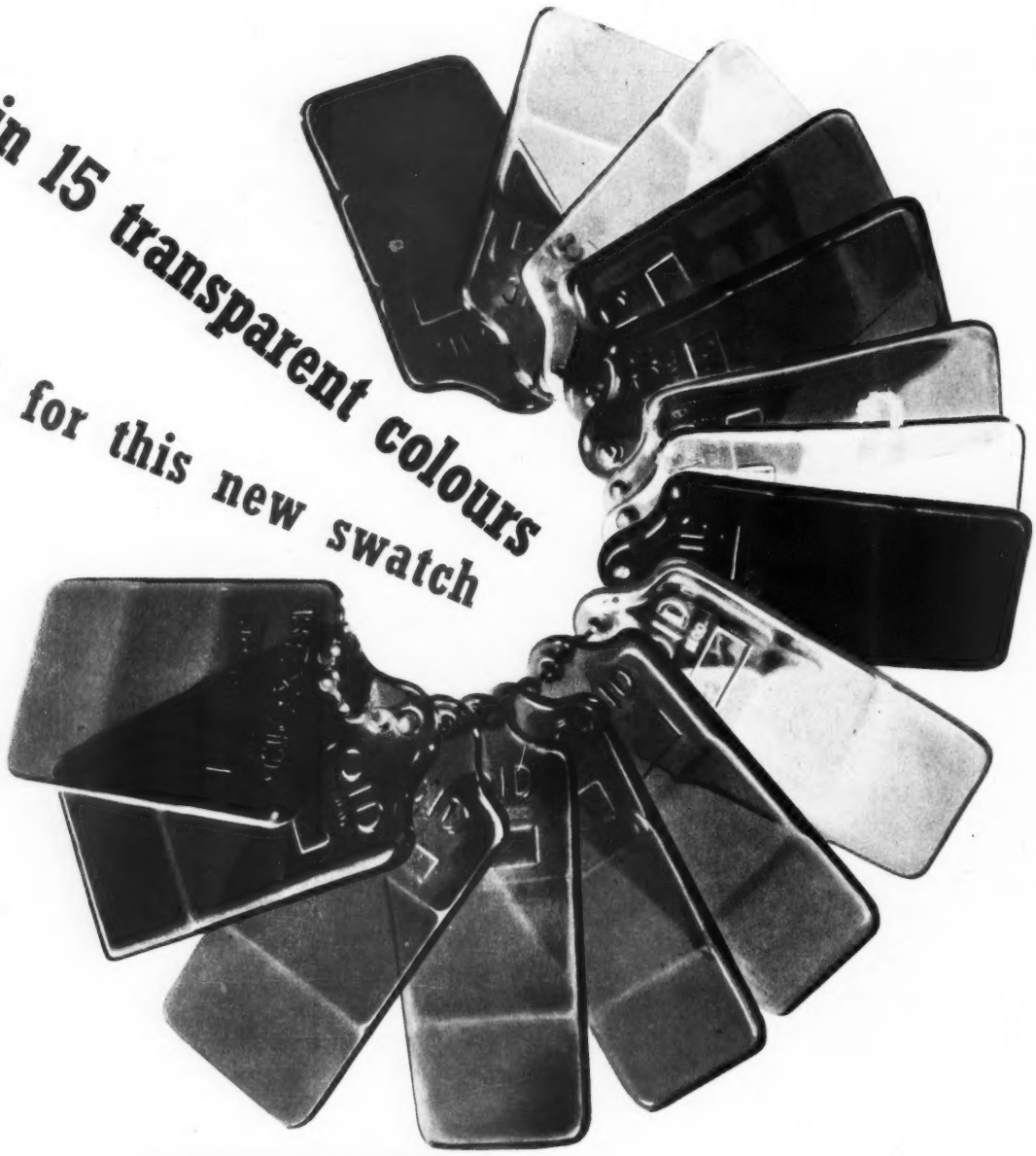

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Plastics

VOL. XV. No. 153. FEBRUARY, 1950.

" But for one complicating fact, many of our rocks could be considered linear, laminated, or three-dimensional plastics . . . we might have been spared all the effort that has gone into the development of the organic plastics and resins had not these inorganic plastics contained one defect, namely, that these chains and sheets, instead of being relatively widely spaced and having only the comparatively weak van der Waals' forces to hold them together, are really very large ions and form ionic lattices with metal ions . . . It remained for animal and plant organisms to develop neutral linear carbon chains whose surrounding fields of force were weak compared to ionic or homopolar bonds."

Samuel S. Kistler, 1945. (Courtesy, Patrick D. Ritchie, " A Chemistry of Plastics and High Polymers," 1949.)

EDITORIALS

Packaging

HOW vastly our methods of packing things have improved in recent years, especially since the war!

Perhaps the General Post Office will glumly tell us, about Christmas time, that the Great British Public seem to have heard little about them and still cheerfully send off presents of turkeys, Xmas puddings and umbrellas in odd pieces of newspaper held precariously together with morsels of string, exposing legs, currants and handles to the vulgar and envious gaze. One day the G.B.P. will realize that high wet-strength wrapping paper and adhesive tape are two great inventions.

Luckily, the manufacturer is more aware of the necessity of packaging his goods properly and is fast learning that the contents must arrive safely and in perfect condition.

Do you sell sledge hammers or gauges to Chile or Pakistan, kippers down the Old Kent Road, or precious " Love's Awakening " in tiny bottles at a bob a drop to the dusky belles of New Guinea? If so, it's up to you to see that they get them in the condition he or she wants them.

Frankly speaking, we don't believe that the road navvies of Chile care to have their sledge-hammers wrapped in lovely transparent plastic film, but your kippers must be. And it's no good sending your best girl a bunch of orchids or a hat wrapped up in last week's " News of the World " or even the " Sunday Times." If you want to see how it's done, how the best milliners send their creations and you don't go to the cinema, turn to page 40.

Do you play with manufacturing liquids or send dangerous chemicals as samples or in bulk? This has been a headache for years and at last we have a few new answers to the problem. Do you know how to send a costly machine tool, bearing, or gauge, to a place where humidity rusts and rots everything? If you keep a shop, can some of your goods be protected from customers messing them about or creating soiled goods that have to be sold at a loss? Do you manufacture a lot of small things, and have you thought of packing a hundred in one package where before you could only squeeze fifty? And you've gone to the trouble of producing beautifully polished metal sheet, so why not try to maintain the lovely surface while it's in store and until your customer gets it?

The foregoing tells the story of tenuous transparent plastic film, strong hot-dipped plastics, modern impregnated sheet and cellular plastics, and it is worthy of note that the only film or sheet types that existed pre-war were of the regenerated cellulose type, cellulose nitrate, cellulose acetate, and little rubber hydrochloride and resin-impregnated paper. To-day the list has been strengthened by polythene and polyvinyl chloride and similar compounds in a great variety of forms.

On the other hand and for different fields of work, the moulded containers, especially for holding razors, shaving soap, perfume bottles, cosmetic powders and pastes, and the like, were the joy of their manufacturers in pre-war days. Happily to-day they are returning and they are possible in a thousand forms for your own especial products—cunning, ingenious, amusing and beautiful designs to hold your perfume bottles, cases to hold the watches you make and show them to the best advantage, bottles that truthfully cannot break and are ideal for travelling cases, boxes to hold fragile samples, containers of special shapes that cannot be reproduced in traditional materials, containers for fancy goods, containers for technical goods, containers that are hard and tough, containers that are soft and strong, and containers that are transparent or not, in any colour you desire.

Toy Fair

FROM January 6 to 13 the beautiful spa of Harrogate became the scene of the annual Toy Fair hitherto held at Manchester. It seems that the British toy-makers and traders hope to make Harrogate, which has so much to recommend it, a European and possibly world centre for the trade. We wish this important trade move every success and if the first Harrogate exhibition is any guide for the future it has already attained it. There were 90 exhibitors each installed in the rooms of two of the largest hotels, and almost everybody was pleased at the exceptionally good business done. One concern had taken over £200,000 worth of orders, which, we suppose, are not due for delivery until the end of the year.

We were pleased to see again Major Jones (Poplar Plastics, Bridgend, South Wales), who confines his work to plastic toys, and to note his delight with the results. He told us that reports to the effect that so many British toys have been copied from American designs is grossly exaggerated. Indeed there is a considerable exchange of ideas. He instanced some of his own and, in particular, a very new one of a pirate raft complete with a belligerent boy pirate that seemed straight out of " Peter Pan," injection-moulded from vinyl chloride acetate co-polymer, a mast and skull and crossed bones, a barrel of rum and a chest for looted treasure. This has already been sent to the U.S.A. for production there. We thought it a brilliantly novel toy.

One old hand told us with startling frankness that there were no really new ideas in toys—there's nothing new under

the sun. He said that when that strange game of "yo-yo" first struck the world in a heap in the 1910s his old boss showed him a 60-year-old toy called the spider-wheel that worked on the same principle. Presumably, since the world of toys is only a reflection of everyday life in little, there is much truth in there being nothing truly new in toys. Still, we need not look for new scientific principles and, as we have an infinite variety of forms at our disposal to shape, we shall always consider each new. It is also true that the simplest non-mechanical doll can be as popular as the most complicated mechanical toy.

How have plastics affected toy manufacture? The process began 70 years ago, but obviously the greatest advance followed pressure and injection moulding. It will follow, we presume, that the more complicated the things we use in normal life become so will the toys, and since they will most economically be made by ingenious moulding, the use of plastics will increase. This trend has already been helped by the scarcity of traditional raw materials, wood and metals, and we should note by the often extremely poor workmanship of many toys made in them during the immediate post-war period. Modern high-class moulding with complex accurate details, coupled with colour or transparency, has surprised the toy trader greatly. Indeed we think that it would pay the latter to examine plastics as completely new raw materials, because of their peculiar physical properties. For example, surely transparency with other properties so different from glass is worth a special study.

Foreign Competition

REPORTS of competition in our export markets from German and Japanese goods in many fields have been common during the past year. The most serious so far as our industry is concerned is stated to be that of electrical goods which, according to "The Daily Telegraph," are being quoted at 50 per cent. lower than the British prices. According to this report, Japanese qualities are poor and contracts cannot always be fulfilled. Nevertheless, this brings us sharply up against the new realities, although we have been expecting them, and so far as plastic moulders are concerned the need for maintaining the high quality of all goods is of the first importance to our future trade abroad.

MOULDING POWDER AND SHOT

E. J. Wilkins, Editor

I first met "Wilkie" about the year 1929 when he and MacFarlane first launched "British Plastics" and I was editing a chemical journal. Obviously our interests touched, and I well remember their early efforts in helping to create the Trade Association, which eventually became the British Plastics Federation, and the first coherent plastics exhibition at the British Industries Fair about 1930. The industry owes much to Wilkins's 21 years of work in its service, and we wish him the best of luck in his well-earned retirement.

* * *

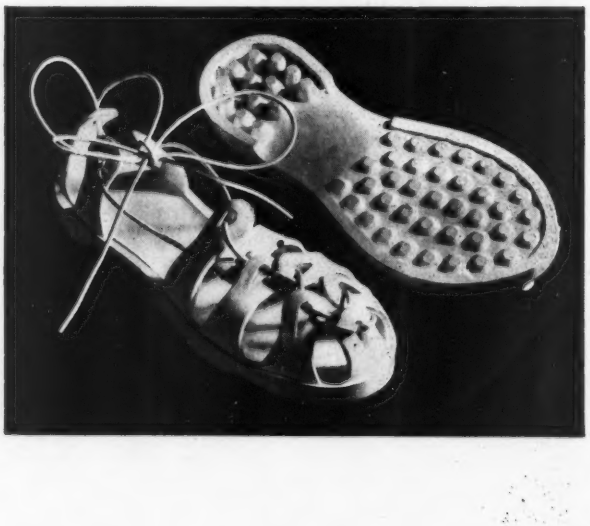
Injection Moulded Rubber

It seems strange that the rubber industry, which began in 1820 and had so long a start, should owe something to the plastics industry for any of its processes. A. van Rossem, the famous Dutch technologist ("Chemistry and Industry," January 28, 1950) tells us that the stimulus to apply the injection moulding process to rubber came from the plastics industry. A Chrysler invention describes a forcing screw with baffles which allows the development of 23,000 lb. in.^{2} pressure at which rubber flows easily into the mould. I should also say that although some of the earliest experiments on high-frequency heating were carried out on rubber, yet its industrial development has been greater in the plastics industry. Its application to rubber is only just beginning. Flow casting of rubber (analogous to slush-moulding) is only now being investigated.

The Light Fantastic

About six years ago a large number of authoritative people outside the boot- and shoe-making industry applauded by a large number of authoritative people within the same industry, declared, for a number of seemingly excellent reasons, that the plastic shoe was not a good thing: (a) p.v.c. might be suitable as an upper but not for the sole; (b) it might be suitable as a sole but certainly not for the upper. A little before Christmas a dance-band leader friend of mine (for I move in the best of circles) told me that he had fitted out all members of his band with new "patent" evening shoes (uppers of p.v.c. and soles of leather) that had just come on the market. They were entirely successful. The shoes appear to breathe adequately, not one has had swollen feet nor added one corn to his existing crop—and heaven knows the modern saxophonist or cornet wielder uses his feet as much as any other limb. I rushed and bought a pair and found that at 16s. they were selling like hot cakes. They seem pretty good, withstood the rigours of a Temple Press staff dance, and, unlike the traditional "patent" type, which attain their gloss by use of an applied lacquer, have so far retained their appearance without a hair-crack on their surfaces; also for your delectation I picked up in France, in August, a novel pair of beach shoes which were all the rage. Made of p.v.c., they appear to have been moulded in one piece very cleverly, I thought. Invaluable for walking on pebbly beaches or hot sands.

DOGSBODDY.

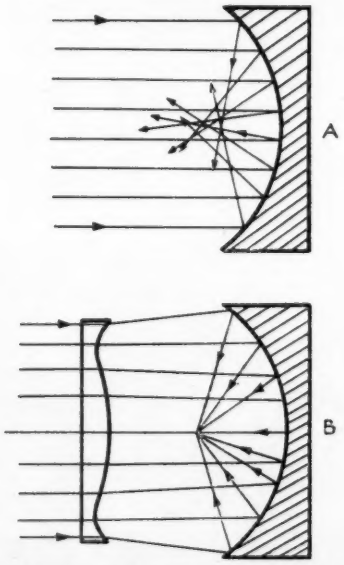


Gelatine and Plastics in Optical Correction Plates

By J. GRINDROD, B.A. (Com.)

UNTIL quite recently is was not possible to manufacture optical correction plates on a large scale. Grinding by hand, so that all scratches and faults were eliminated, was tolerated for single plates for use in a telescope, but this finishing-off process was too involved and cumbersome for the greater production which television, and scientific photography in a wider field, demanded.

Correction plates are used in optical systems to eliminate spherical aberration when this cannot be done by the use of a diaphragm and a strong light source. They were first invented about 20 years ago by B. Schmidt, an instrument maker who lived at Bergendorf, near Hamburg Observatory, and whose name is now used to describe optical systems which incorporate these correction plates.



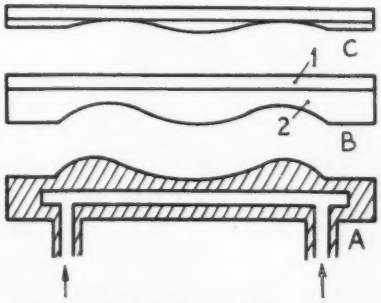
(A) Parallel rays at different distances from the optical axis, after being reflected from a spherical mirror, do not concentrate in the same focus, but at different points.
(B) Correction plate causes all parallel rays to concentrate in the same focus.

By use of a spherical concave mirror, and by placing a correction plate made of glass that was not everywhere equally thick in the centre of the concave, Schmidt overcame the difficulty of the reflected rays not concentrating at the same focus. The plate of varying thicknesses caused the parallel rays of light to be broken a little differently as though they were individually transmitted through a prism, and this diffraction was just sufficient to correct the aberration.

In recent years optical instrument makers have asked whether or not correction plates could be made from plastics. Indeed, polystyrene has been so used in the United States and correction plates of this material have been much easier to manufacture by comparison with the ground glass plates originally used. First, a mould is made of the form required, which has to be accurate and must have an optical quality surface; that is, the mould must not only faithfully follow the remarkable curvature of the correction plate, but even the slightest errors, roughnesses and cracks have to be avoided. The surface must also be able to withstand pressing and heat treatment. The mould is usually made by hand, then polished and carefully finished. A separate mould is required for each shape of correction plate.

At the laboratories of N. V. Philips Gloeilampenfabrieken, at Eindhoven, Holland, however, another course has been pursued. Here an entirely new method for the manufacture of correction plates has been worked out.

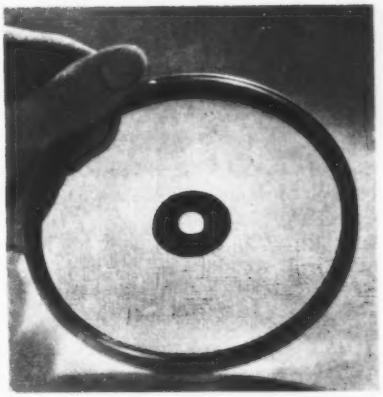
A metal mould is made on a precision lathe, the shape of the surface being the negative of the correction plate. This



(A) Cross-section of mould for a correction plate, showing tubes for circulation of warm and cold water.
(B) Correction plate with gelatine layer before drying: 1, glass plate; 2, gelatine layer.
(C) Same correction plate after drying.

mould has diagonally the same dimensions as the correction plate, but it is about five times as thick. Thus a mould with a total variation in thickness of 2.5 mm. would be used to produce a correction plate with a total variation in thickness of 0.5 mm. The mould is carefully polished, and is heated to about 40 degrees C. by passing warm water through tubes in the mould.

A gelatine solution is poured onto the mould and a glass plate is placed over it



The Philips correction plate eliminates distortion at the edges of a lens.

and pressed to within a short distance by adjusting screws in order to remove superfluous gelatine. Cold water is then passed through the mould, causing the gelatine to form a solid mass, which adheres to the glass plate, and which reproduces exactly the shape and contoured surface of the mould.

As a further stage, formaldehyde vapour is used to harden the gelatine, which is then dried uniformly. During cooling and drying shrinkage takes place, but as the gelatine is kept rigid in lateral directions by means of the glass plate this shrinkage will occur only as regards thickness. After drying is complete, the thin layer of gelatine which remains is a fivefold reduction of the surface of the mould. Shrinkage is most uniform and accurate, and the smooth, gelatine surface carries every detail of the mould, reduced but otherwise unchanged.

The resulting hardened gelatine layer appears to be stable, but it may be desirable to protect the surface against damage by wet fingers or moisture.

The mould can be five times less accurate than actually required for making a correction plate, as the reduction of the gelatine reduces errors to one-fifth. For instance, fine scratches are no longer a disadvantage, because their ultimate depth in many cases (after the drying of the gelatine) will be less than the wavelength of light. As there is no pressing involved in this process, there is, consequently, no danger of distortion. The hard gelatine layer is notably resistant to scratches and there is no objection to cleaning the surface with a soft cloth.

It may also be noted that the same mould can be used for making correction plates of different optical strength by use of variations in the concentration of the gelatine solution.

The branches of photography that will benefit from the manufacture of correction plates on a wider scale relate to astronomical telescopes, cameras used for recording X-ray images on a fluorescent screen, and television

Aniline Formaldehyde Resin, its Production and Uses

IT is a strange fact that so few references in the literature are made to aniline formaldehyde resin. Some of the best-known technical and scientific books on plastics contain no reference whatsoever to it, in spite of the fact that it has been made in Switzerland where it was discovered, in England, Germany and the U.S.A. for the past 20 years or more, and that it finds important use both as a moulding material and as a resin for producing a laminating paper because of its especial electrical properties.

Aniline formaldehyde resin occupies a special niche in the synthetic resin family, for while when heated under pressure it fuses and flows and is thus moulded into the solid form, it does so without condensation and therefore without any formation or evolution of water. Since also these mouldings are made from the pure resin and without any filler which might absorb moisture, they possess excellent dielectrical properties and maintain them.

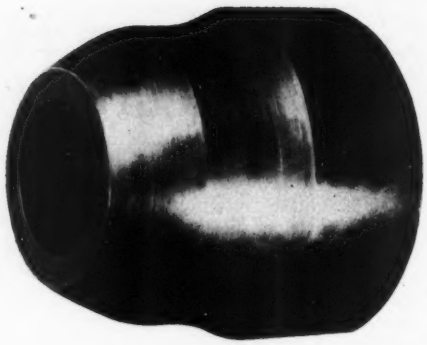


Fig. 1.—Moulded insulating unit (X-ray apparatus) in "Panilax" resin.

The Micanite and Insulators Co., Ltd., of Blackhorse Lane, Walthamstow, London, is the only company in this country which has devoted itself to the production of this resin—a logical addition to its other outstanding manufactures in the electrical field, varnished papers and fabrics, shellac-bonded built-up mica sheets and phenolic-resin impregnated paper for flat and tubular laminates and the production of condenser bushings. It is, however, with the aniline resin that we are concerned here, and the scene of manufacture is not at Walthamstow, but at Roughway, near Tonbridge, in the county of Kent. The reason for this change of venue becomes clear when it is realized that the resin-making plant is actually on the site of a paper mill. Thus, not only is the pure resin powder for moulding purposes made here, but is also incorporated into pulp and converted in the paper mill into

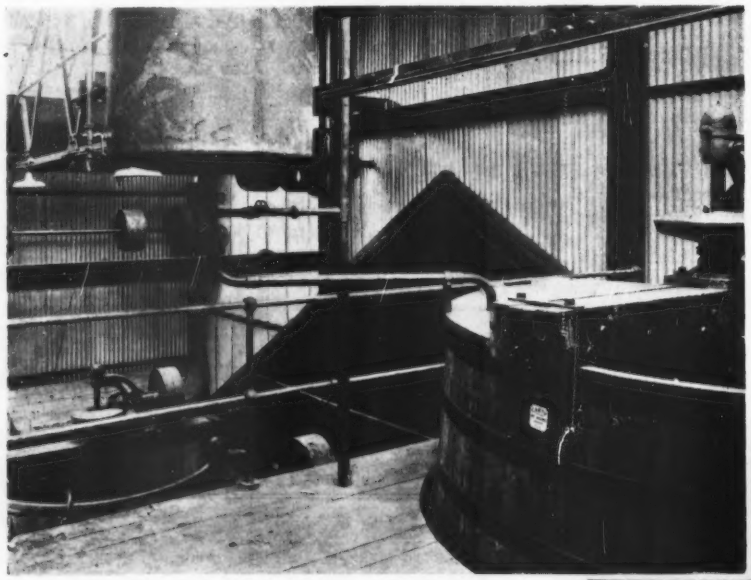


Fig. 2 (above).—Aniline hydrochloride and formaldehyde reaction vat. The aniline hydrochloride solution is pumped into the Carty vat and formaldehyde is added from the overhead tank.

Fig. 3 (above).—Resin precipitation. Resin solution from the reaction vat seen overhead is dropped by gravity into caustic soda.

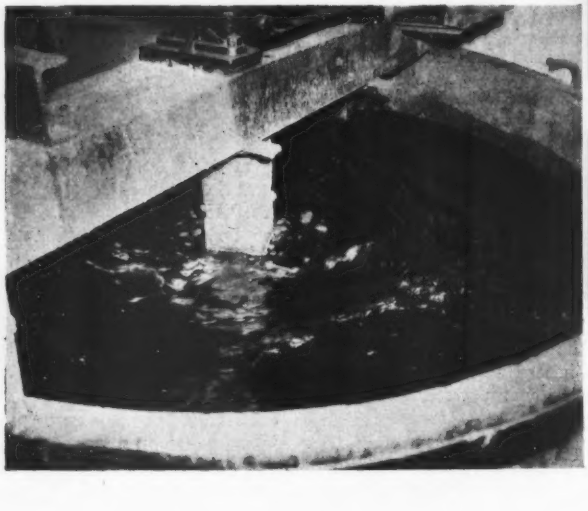


Fig. 4 (left).—Precipitation vat during addition of resin to soda with agitation.

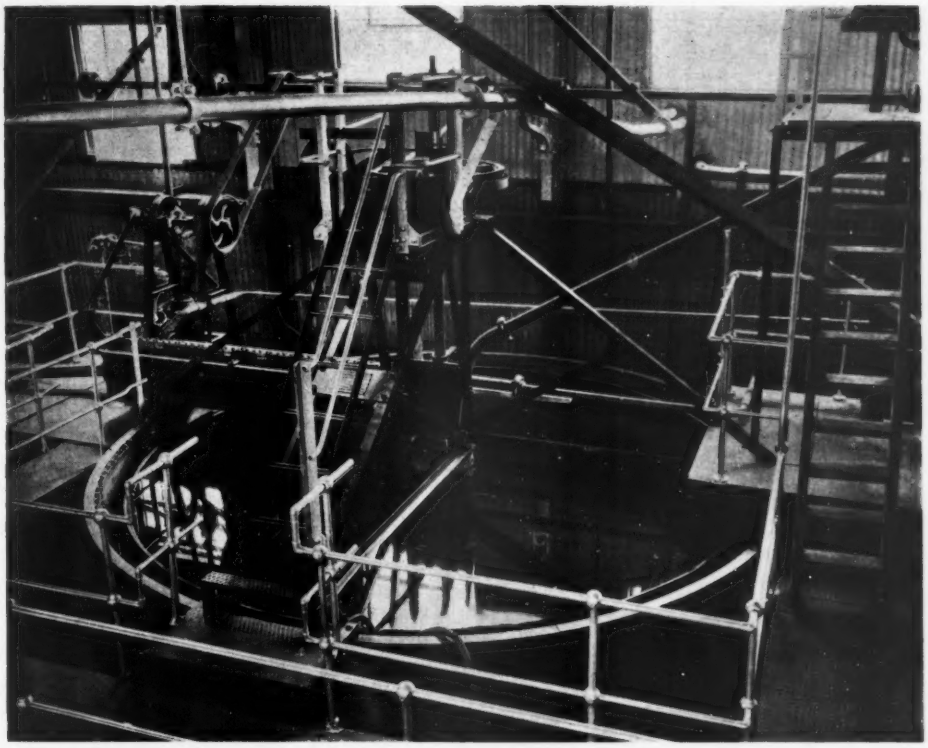


Fig. 5.—Separation and washing of pure aniline-formaldehyde resin is carried out in a series of Dorr thickeners.

a resin-impregnated paper, both resin and resin-impregnated paper being then transported to Walthamstow to be moulded or otherwise formed.

Production of the Resin

Since its manufacture bears little relation to that of any other synthetic resin, and since also we believe that it has not been previously described in the literature in adequate detail, we have pleasure in giving the following notes.

The raw material is aniline (derived from coal-tar benzene by nitration and reduction of nitro-benzene), better known for its world-wide employment as an intermediate in dyestuffs manufacture. Since aniline is an amino-compound, it can form with acid a salt which is readily soluble in water. Moreover, since formaldehyde reacts with aniline in the cold and in acid solution, production from the "acidic" salt is appropriate.

The aniline is first treated with dilute hydrochloric acid to produce an aniline hydrochloride solution containing about 12 per cent. of solids. This is pumped into a large Carty wooden vat provided with a powerful wooden agitator. Stirring is commenced and formaldehyde solution is fed in slowly and at a constant rate. Reaction takes place immediately with a rise in temperature and a change in colour to a deep orange red—stirring being continued until the requisite quantity of formaldehyde is added. One ratio of aniline hydrochloride to formaldehyde is employed and carefully controlled, since too great an excess of formaldehyde produces a resin of high melting point.

The resin is now formed but it exists in this vat as a water soluble material from which it must be freed. It is therefore dropped by gravity through a valve in the base of the vat to a second wooden vat at a lower level containing a 10 per cent. caustic soda solution and also provided with an agitator. The soda immediately reacts with the hydrochloride, releasing the resin as a creamy yellow precipitate or slurry.

Again, by gravity, this slurry is fed to the first of a series of four Dorr "thickeners," a process which entails the use of a counter-current flow of fresh water removing the soluble common salt (sodium chloride) that forms in the reaction and excess formaldehyde, whilst the resin is "thickened" and drops through a cone-shaped bottom to be fed to succeeding Dorr thickeners. Thus, the resin gradually becomes completely free from salt and is finally removed in a very pure state from the base of the last Dorr thickener into a canvas trough. This resin, however, still contains 90 per cent. water and is then dried down to 30 per cent. moisture content in a L. A. Mitchell, Ltd., drying oven. In this condition it is transported to Walthamstow, where it is dried still further after disintegrating in a ball mill. The final resin contains less than 0.1 per cent. moisture. Production is at the rate of half-ton per batch.

Resin Impregnated Paper

When it is desired to make resin-impregnated paper, the same plant is used, but the procedure is slightly altered. The

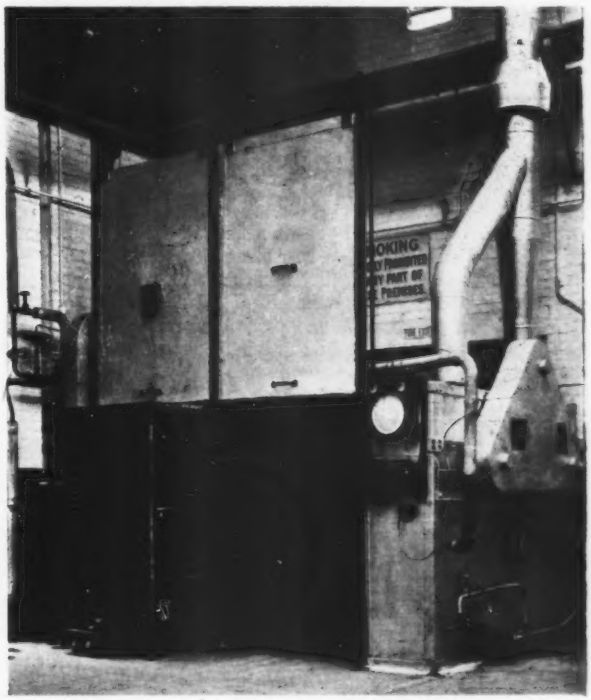


Fig. 6.—Drying the resin from the Dorr thickeners in a thermostatically controlled drier (L. A. Mitchell, Ltd.).

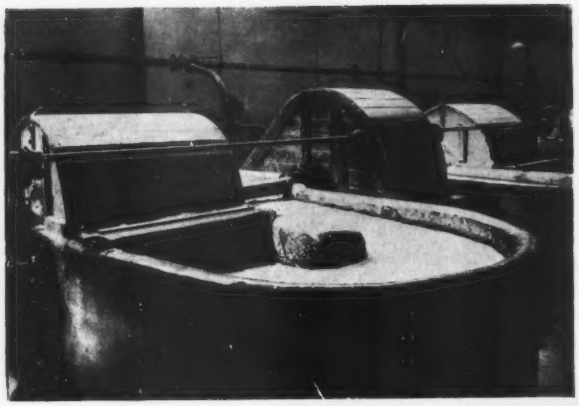


Fig. 7 (above). — Paper beaters, where the pulp is made.

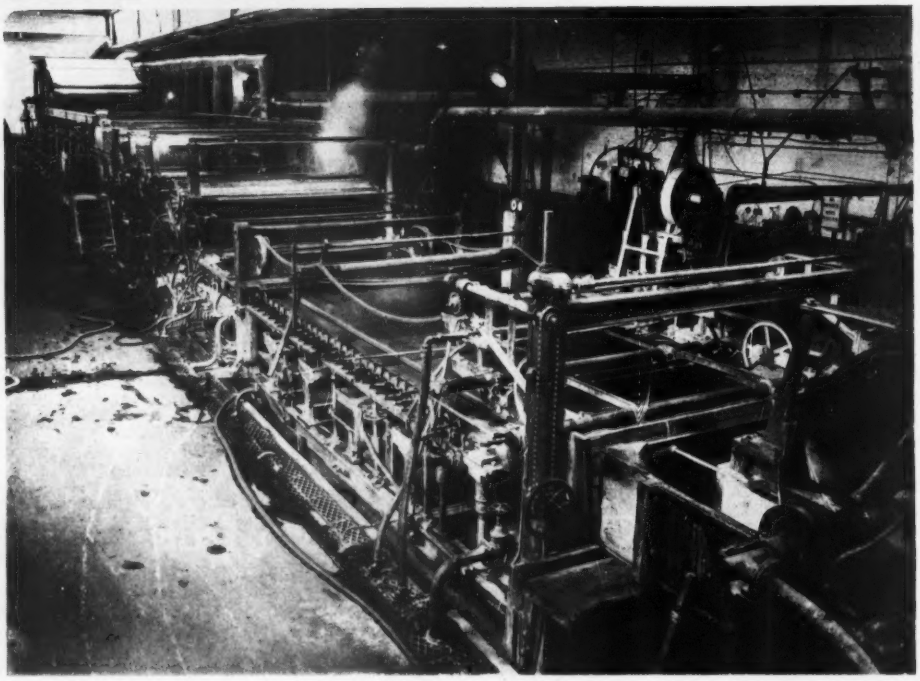


Fig. 8 (right).—The paper-making machine. The paper emerging from the final heated calender contains 50 per cent. resin by weight.

second wooden vat instead of containing caustic soda, is filled with paper pulp and the aniline formaldehyde "salt" from the first vat is dropped into it and the whole is thoroughly agitated. The soda is then added, as before, to throw out the resin itself, the pulp thus becoming completely impregnated with it. The proportion employed is quarter-ton of paper pulp and quarter-ton of resin. Again, the slurry so formed goes through the Dorr thickeners for purification from contained electrolyte, that is, common salt, but, for obvious reasons, the clean slurry is not freed from water but is fed directly to the paper-making machine. From the final heated calender it issues as paper containing 50 per cent. resin by weight.

Moulding of the Pure Resin

The pure resin, known under the trade name of "Panilax," does not, as previously stated, condense or polymerize under heat and pressure. Thus, no water or other volatile matter is liberated, and no further chemical action takes place in the mould; it is a thermoplastic material, but when moulded its plastic yield is high, so that mouldings may be employed at 90 degrees C. without deformation. "Panilax" possesses the desirable properties of good electric strength and heat resistance, coupled with better resistance to "tracking" than the phenolic resins possess. Hence its outstanding value for highly electrically stressed applications and where dimensional stability is important. With a loss factor of 0.04, "Panilax" moulded resin is a suitable insulator for the higher frequencies. It is also resistant to alkalis, organic solvents and oils, but obviously is affected by acids. The density of such mouldings is 1.2. A good example of the general method of moulding is that given by the production of flat sheet from the pure resin powder (see Fig. 9). The press employed is of 500-ton capacity. The weighed powder is loaded into the cavity and carefully levelled with a depth-gauge leveller. This apparently simple work is carried out by a very skilled worker, for since there is fusion but limited flow, all depends upon this care for high-quality results. A direct indication of the close detail carried out is the time taken to produce a ½-in. sheet on this press—1½ hours total time.

Moulding of the pure resin is, as has already been stated, confined to simple shapes, but Fig. 1 shows a somewhat more complicated form, an insulating unit for X-ray apparatus. All moulding of this resin is carried out in positive moulds.

"Panilax" lends itself admirably to machining, as will be readily seen in Fig. 11, where work is being carried out on a moulding held in a centre lathe, and in Fig. 12, where a thick resin plate is being drilled under a drilling jig. This plate is part of a unit used in the electrical treatment of water for softening.

The aniline-formaldehyde impregnated paper is employed for a variety of purposes, one of the most important being the construction of laminated sheets 30 ins. by 80 ins. in thicknesses of from $\frac{1}{16}$ in. to 3 ins. or more. The sheets of paper, each 0.005 in. thick, are cut to size and stacked in numbers, varying according to the final thickness required. Continuous sampling to ensure that the moisture content is below 0.5 per cent. is carried out at this stage. Five stacks, each separated by carefully cleaned and polished metal plates, are placed on the loading platform of the "five daylight" 4,000-ton John Shaw press shown in Fig. 14, and loading is commenced. This needs three men to carry out, the platform being raised as the succeeding daylights are filled. Pressure is at 3,000 lb. per sq. in., the temperature 160-170 degrees C. and the pressing time 2½ hours. This is followed by a cooling period, the whole cycle taking 3¼ hours. The finished sheets are then removed and trimmed square or

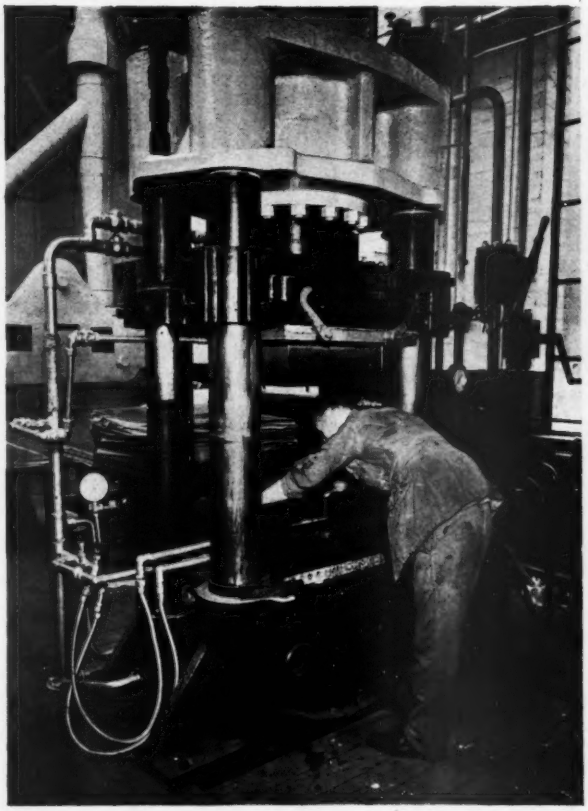


Fig. 9.—Flat sheet produced from pure "Panilax" resin powder in 500-ton down-stroke press. The operator is seen levelling the resin.

Fig. 10.—View of moulding shop, showing 50-ton semi-automatic press for moulding "Panilax" resin.

Fig. 11.—The operation of machining "Panilax" resin moulding held in a centre lathe.

Fig. 12.—Drilling machine and jig for drilling "Panilax" laminated.

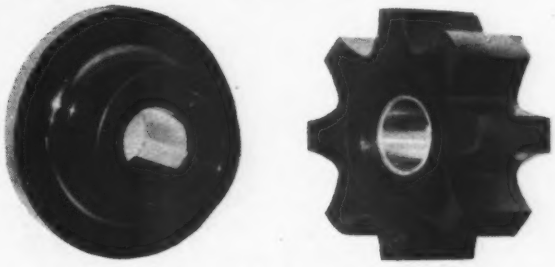


Fig. 13.—Two relatively simple shapes moulded from pure "Panilax" resin.

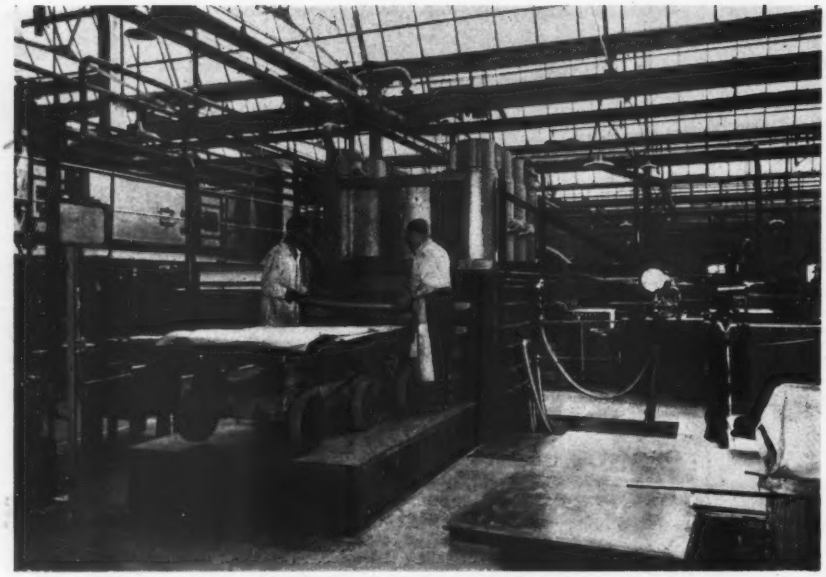


Fig. 14.—"Panilax" laminated sheet is produced in this 4,000-ton John Shaw press, here seen with the loading platform raised.

Fig. 17.—Philips X-ray apparatus is used for testing "Panilax" resin powder.

Fig. 15.—Downstroke press and mould for "Panilax" laminated hexagonal rod.

Fig. 16.—The "Panilax" hexagonal laminate circuit-breaker lifting rod, made from rod moulded in the press shown in Fig. 15.

sawn into smaller sizes, as required by the electrical industry for further machining.

Moulding of Sheet

While true moulding may be said to be confined to the pure "Panilax" resin, it is nevertheless also the practice to mould certain special forms from the impregnated paper. One of these forms is the well-known "Panilax" hexagonal circuit-breaker lifting rod (Fig. 16) the moulding of which is carried out in the downstroke press and mould shown in Fig. 15. The paper is rolled in a special manner, is inserted into the lower cavity, and pressure at 7,000 lb./sq. in. is exerted. The hexagonal rods are produced in sizes up to 54 ins. long by 2¼ ins. across flats.

Testing of Finished Products

All finished goods and units are tested by the usual electrical tests after production, especially as to dielectric strength, permittivity, power factor, and mechanical strength. At this point it is interesting to note the use in this factory of X-ray methods. As the resin arrives from the factory, average samples are taken for the detection of impurities. Each is placed in a "Cellophane" bag and exposed to the X-ray apparatus (Fig. 17).

In conclusion, we must thank Major Stanley M. Mohr, O.B.E., M.C., M.I.E.E., for his kind permission to visit these works which renders such magnificent service to the electrical industry, and to Mr. A. Collins and Mr. E. L. Potter, of the Technical Departments, for their great help and patience in explaining the details of the numerous processes involved.

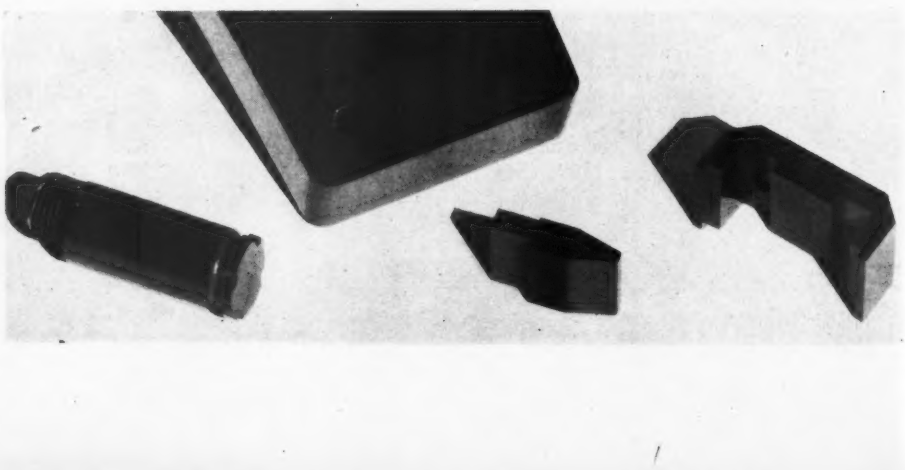


Fig. 18.—Examples of industrial component parts machined from "Panilax" laminated by drilling, turning, etc.

World's Industry Employs Plastics

GENERAL ENGINEERING

Heavy-duty bearings with intermittent oscillation.—R. R. Bush tested a variety of materials for bearings in switch gears. "Textolite" tubing (cotton cloth and thermosetting phenol resin) was found to be superior to metals. Friction coefficient, appreciably lower than for most metallic bearings, decreases when load increases. Low modulus of elasticity gives resistance to impact. Flexibility distributes stress over whole bearing surface. Lubricant absorbed into surface. Consequently higher specific bearing loads are possible. ("Mechanical Engineering," 1949/Nov./911.)

Station-wagon bodies of laminated hardwood are produced by a special technique by Ford Motor Co. Thin wood plies are used for the door, quarter-panel, window and tailgate frames. Dielectric heating is applied. ("Automotive Industries," 1949/Nov. 15/37.)

New filler materials for carburetter air filters.—Replacing the fine copper turnings, casein fibres ("Caslen") and pure wool impregnated with tricresyl phosphate give controllable features such as length, diameter and tightness of curl to assure interlocking of the finished material and to prevent matting. ("Materials and Methods," 1949/Nov./67.)

Materials for plastic mould cavities.—A wide variety of mould materials is now available, and L. J. Morrison gives valuable hints how to choose the most economical one for a given application. Careful evaluation of the many factors involved is necessary. ("Materials and Methods," 1949/Nov./61.)

Three-speed plastic press.—A new Turner 125-ton up-stroke compression-moulding press (Turner Manufacturing Co., Ltd., Wolverhampton) is made self-contained by a sealed-unit hydraulic system. The cycle contains three different speeds, i.e., 4½ in./sec. for closing, ½ in./sec. for pressing and 2½ in./sec. for opening. ("Machinery Lloyd," 1949/Nov. 12/83.)

Hydraulic operation of injection moulding machines.—W. Venus deals with movements and forces on injection moulding machines for thermoplastics, and describes the new hydraulic injection moulding machine of Hahn and Kolb, which has closing pressure of 60 tons, injection pressures 8 to 15 tons, and volume of charge of 80 c.c. ("Kunststoffe," 1949/Oct./249.)

ELECTRICAL

A circuit breaker redesign makes better use of phenolic resins. The article compares the new design with the old one. Care was taken to avoid metal inserts, so that the moulded parts could be used together with simply shaped metal parts. A complete moulded base is used. ("Product Engineering," 1949/Nov./107.)

Plasticized p.v.c. as cable insulator.—W. Birnthaler discusses critically the material properties of plasticized polyvinyl chloride as insulator for cables. It is admitted that p.v.c. is not a universal material and should be used only for certain fixed applications. By the choice of certain plasticizers and their contents the cables can be made to correspond to certain requirements. Mixtures can be made water resistant and become safe even under direct current and moisture. ("Kunststoffe," 1949/Dec./301.)

New conductive plastics can be moulded like ordinary plastics and directly plated. Electrical resistivity approaches that of mercury. These products of Markite Co. have promising applications for shielding, moulded circuits, resistors, commutators. ("Electronics," 1949/Oct./96.)

Standardization of foils.—The standardization of properties and testing methods for foils for insulating purposes as used in the electrical industry is under consideration in Germany, making use of American A.S.T.M. tests. ("Kunststoffe," 1949/June/155.)

MISCELLANEOUS

Bio-plastic embedding.—Ward's Natural Science Establishment reports on progress in embedding specimens in plastics by first impregnating the tissue in glycerine. ("Ward's Natural Science Bulletin," 1949/Nov./24.)

Classification of natural and synthetic organic materials.—R. Lepsius makes an interesting contribution to the problem of classfication and nomenclature of plastics, whereby he accepts the suggestions of Nitzsche and Hering to accept the general name "Plast," being an adaptation of "plastics" as used in the English and French languages. ("Kunststoffe," 1949/Nov./288.)

Flame-spraying polythene.—The Du Pont Co. has developed a successful method for flame-spraying polythene. The problem was to melt the material and to keep it at a high temperature without overheating. ("Products Finishing," 1949/Nov./22.)

Novel use of "Alkathene 200".—This hydrocarbon base plastic has been used successfully instead of lead for bending, shaping and partly planishing the spout of a teapot in silver. The tough and flexible plastic will withstand vigorous hammering without fracturing. It melts at 110 to 115 degrees C., and can be heated up to 190 degrees C., with increase in fluidity. ("Bulletin, Design and Research Centre for the Gold, Silver and Jewellery Industries," No. 7/1949/13.)

Automatic rifle with plastic stock.—Intricate internal shape of new Stevens model 87 rifle (Savage Arms Corp., Chicopee Falls, Mass.) would require extensive woodworking. Stock moulded in "Tenite" has natural lustre, eliminating hard finishing needed for wood. ("Product Engineering," 1949/Dec./105.)

Ethyl cellulose.—As explained by P. A. Belk, this material, although more costly than some plastics and more difficult to mould than others, has special properties which make it a satisfactory material for many applications. ("Materials and Methods," 1949/Sept./64.)

Impact testing.—B. Maxwell and L. F. Rahm present a new method for testing the impact strength of polymeric plastics, said to eliminate some of the extraneous energies measured by the standard Izod test, the most important of which is the energy to toss the broken half of the sample. Testing can be carried out over a wide range of velocities. ("ASTM Bulletin," 1949/Oct./44.)

Urea-formaldehyde resins for textile finishing are reviewed by L. Shapiro. After an historical review the chemical composition, commercial products and fields of application are treated. ("Rayon, Synth. Textiles" (N.Y.), 1949/No. 7/39.)

Transparent plastics versus glass.—K. Rose compares the plastic glasses with the inorganic ones and finds that owing to their clarity, flexibility and formability the organic glasses find use in many fields where glass was formerly the only material available. ("Materials and Methods," 1949/Nov./69.)

Hard casting plastic (produced by Furane Plastics and Chemicals Co., 719, W. Broadway, Glendale 4, Calif.) on amino resin basis is said to offer improved water resistance, greater strength and a longer working life. Barco hardness is 65 to 70. Reinforced with glass flock fillers, it can withstand high working temperatures. ("Materials and Methods," 1949/Nov./110.)

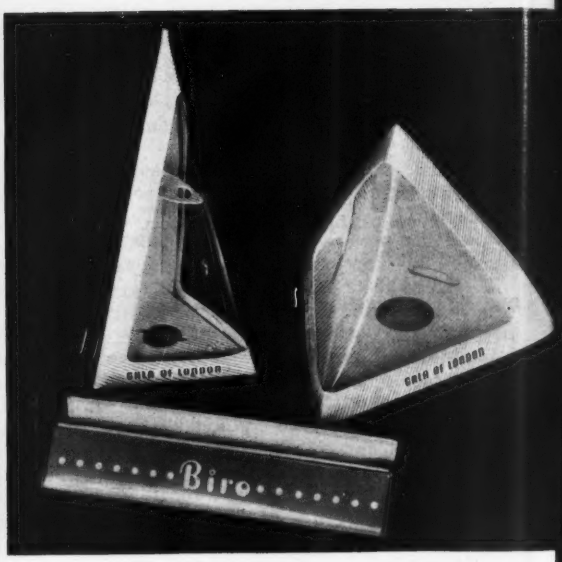
PLASTICS
IN THE SERVICE OF MAN

A pictorial review of high-quality units moulded or otherwise fabricated in Great Britain . . .

7. Packaging.

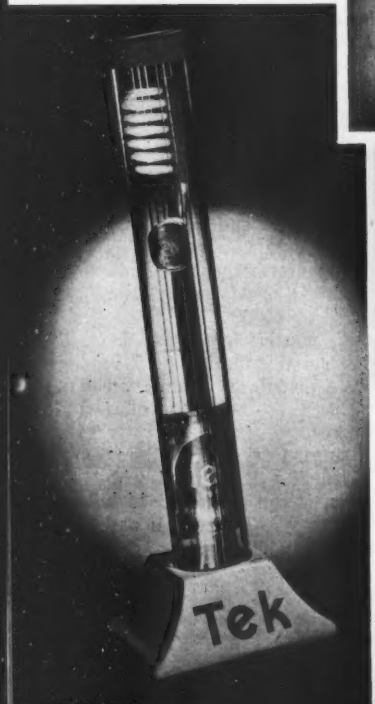
(Above) Convenient containers for books of chemical laboratory test papers are injection moulded in polythene by Fraser and Glass, Ltd., for Johnsons of Hendon, Ltd.

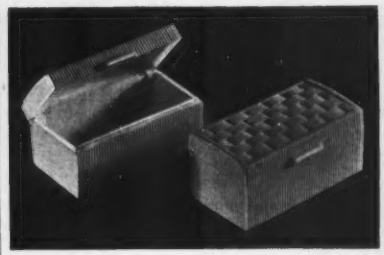
(Above and right) "Lay-flat" tubes of extruded polythene are readily heat-sealed to provide packaging for a variety of goods and foodstuffs. These photographs relate particularly to such lay-flat tubes in "Alkathene." (I.C.I. Plastics Division.)



(Above) Two of these packs, with transparent "windows," of "Clarifoil" cellulose acetate film (British Celanese, Ltd.) are produced by Field, Sons and Co., for "Gala of London" cosmetics. The pack for the "Biro" pen uses "Clarifoil" as a wrap-round, and is made for Miles-Martin Pen Co., Ltd.

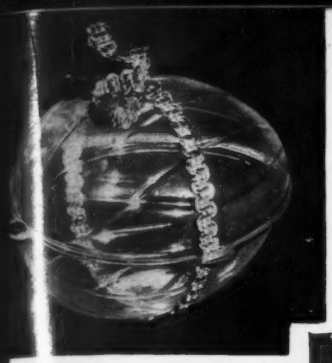
(Below) Group of containers in opaque and transparent cellulose acetate, by Cascelloid, Ltd.





(Above) Small caskets, injection moulded in ivory cellulose acetate by Mentmore Manufacturing Co., Ltd., are made exclusively for "Goya" perfumes.

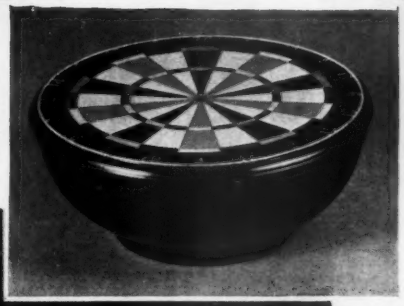
(Left) This seamless transparent container for the "Tek" tooth-brush is made by De La Rue Extrusions, Ltd.

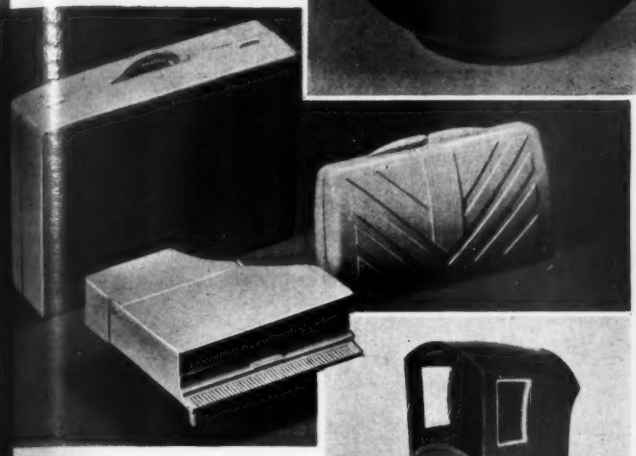


(Left) Transparent Easter egg pack, made from cellulose acetate by Utilex, Ltd.

(Right) Moulded boxes for handkerchiefs, made for Tootal Broadhurst Lee Co., Ltd., by The Streetly Manufacturing Co., Ltd.

(Right and below) Shaving soap bowl and novelty perfume packs, moulded by Crystalate, Ltd., for J. and E. Atkinson, Ltd. (These packs were made prior to 1939.)



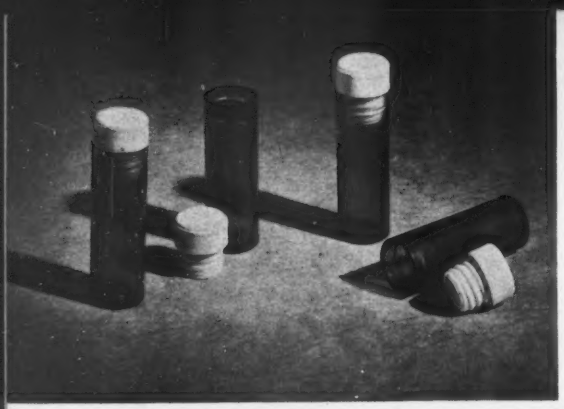


(Right) Container for phenolic resin modelling paste, moulded in polythene by McMurdo Instrument Co., Ltd., for Crystyl Chemical Co., Ltd. ("Plastics," 1949/July/373.)

(Below) "Nutrapac" container for liquids, with inner bag of p.v.c. sheet, by Tanks and Linings, Ltd.

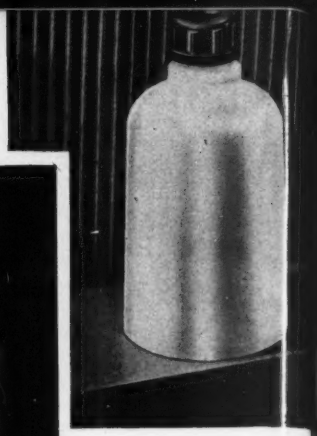
(Above) Fabricated cellulose acetate boxes for packing stockings, brushes and sponges, by John Dickinson and Co., Ltd.

(Right) Storage box for "Earlywarm" Witney Point blankets (Charles Early and Co., Ltd.), fabricated in "Perspex" by Thermo-Plastics, Ltd.

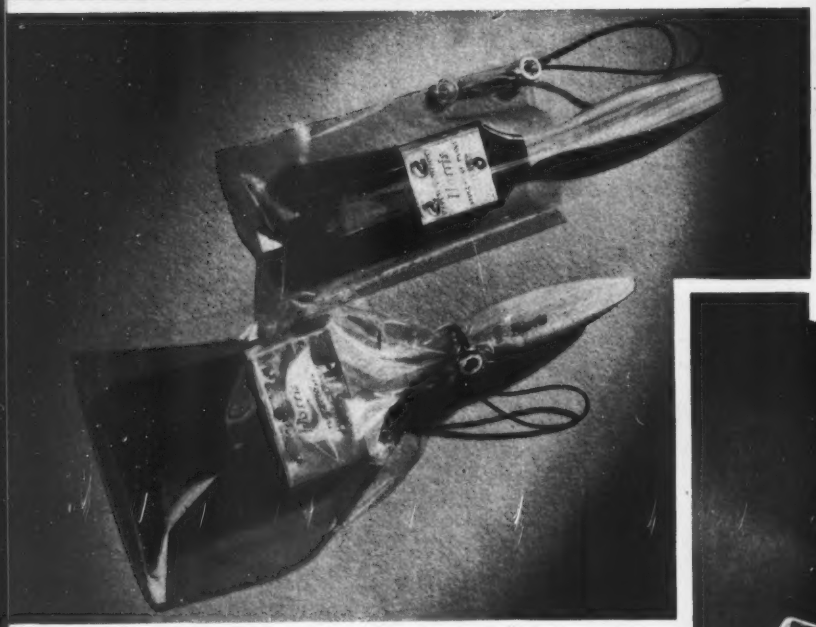


(Left) Injection moulded polystyrene bottles for packing medicinal tablets, etc. (Cascelloid Ltd.).

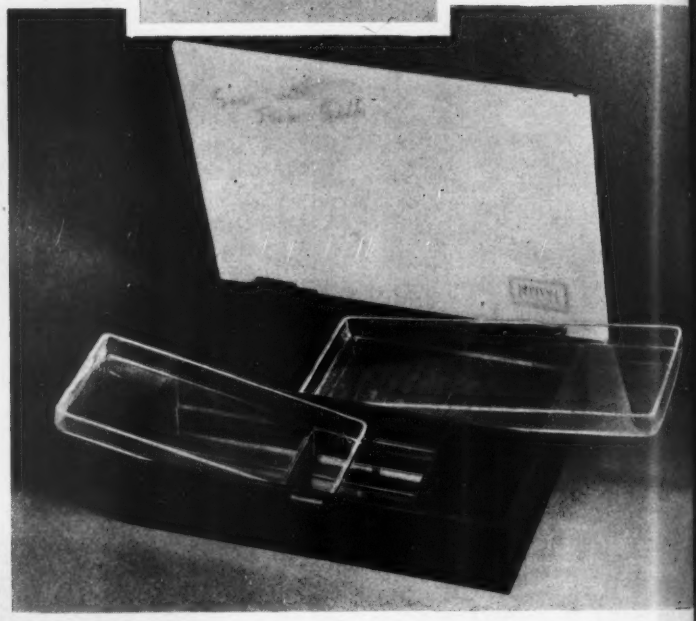
(Right) Polythene bottle by Redifon Ltd. Overall height 4 ins., diameter 1¾ ins., weight under ¾ oz.



(Above) This "Telcothene" (polythene) bottle for laboratory use is made in a range of sizes up to 16 fluid oz. by The Telegraph Construction and Maintenance Co., Ltd.

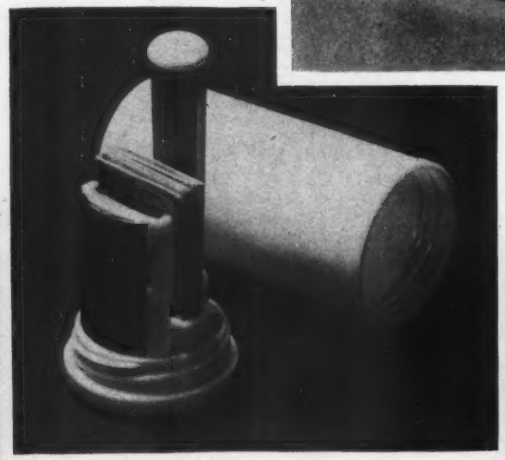


(Above) "Pliofilm" rubber hydrochloride film, by The Goodyear Tyre and Rubber Co. (Gt. Britain), Ltd., is used for making these "Brush-away" paint brush protective packs.



(Above) "Bakelite" and "Perspex" provide the contrast in colour for this sewing silk box made by Thermo-Plastics Ltd. ("Plastics," 1949/Feb./63.)

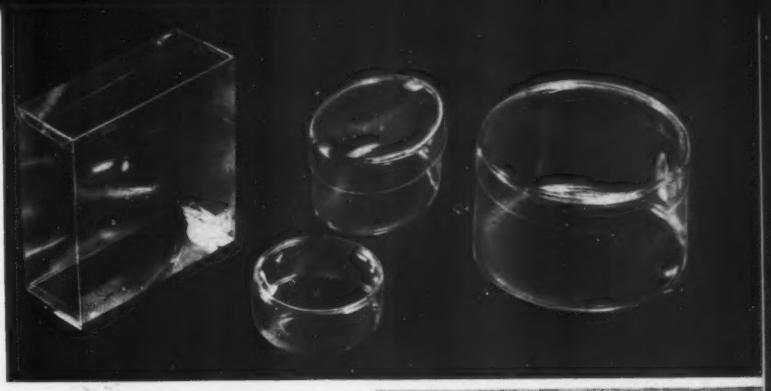
(Below) Dispenser for "Sellotape" transparent adhesive tape, moulded in "Beetle" by The Streetly Manufacturing Co. Ltd., for Adhesive Tapes Ltd.



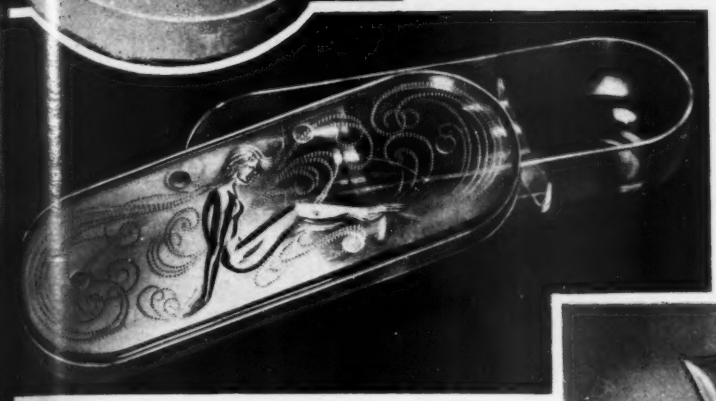
(Above) The container, and other parts, of this safety razor set by Souplex Ltd., are moulded in urea.

(Right) Paper coated with vinyl copolymers is finding use for the packaging of salt and other products needing protection from moisture. ("Plastics," 1946/Dec./623.)

(Left) This drum has an inner lining of "Alkathene" (polythene) to provide protection for hygroscopic products. (I.C.I. Plastics Division.)

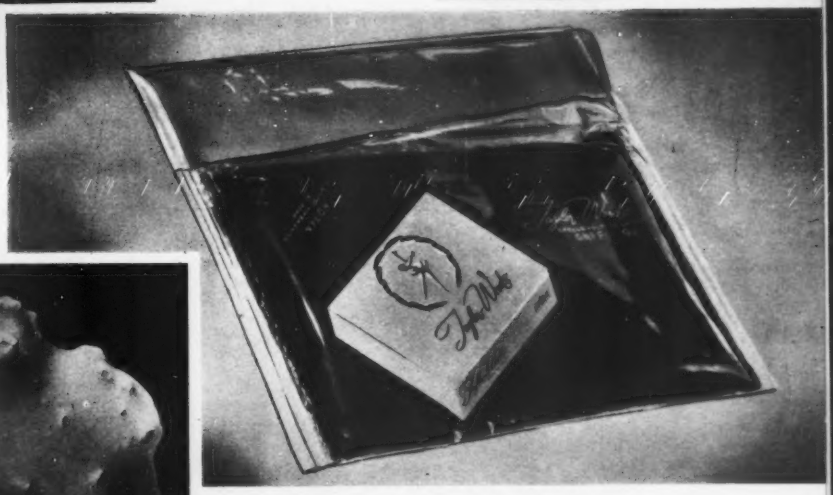


(Above) Cellulose acetate containers by Utilex, Ltd.



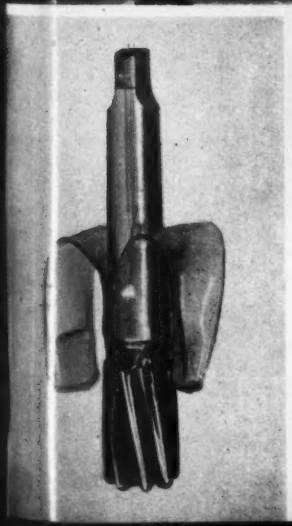
(Above) Soap-box, injection moulded in polystyrene for Harry Green, Ltd., by Universal Metal Products, Ltd.

(Right) The "Gloscoat" hot melt dipping process, based on ethyl cellulose, provides strippable protective coatings for engineering components, tools, etc. (J. M. Steel and Co. Ltd.)



(Above) "Pliofilm," made by The Goodyear Tyre and Rubber Co. (Gt. Britain), Ltd., is employed as a protective wrapping for nylon stockings.

(Above) "Cocoon" sprayed-on plastic packaging for protection of aero-engine during storage and transport (R. A. Brand and Co. Ltd.). ("Plastics," 1947/Sep./462).



(Left) "Safepak" protective packaging for machine tools. (Birmingham Tool and Gauge Co. Ltd.)

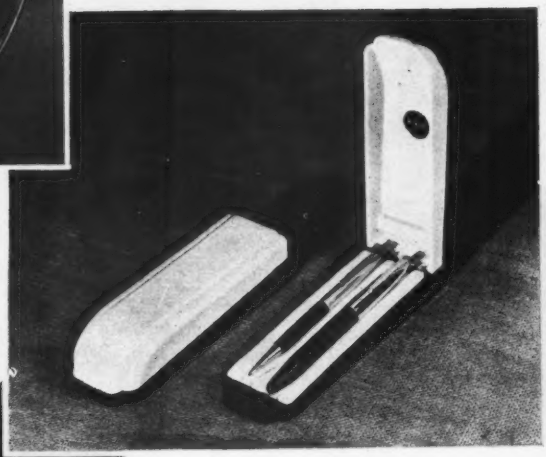
(Right) Collapsible barrel of resin-bonded wood laminate, by Merron Ltd.

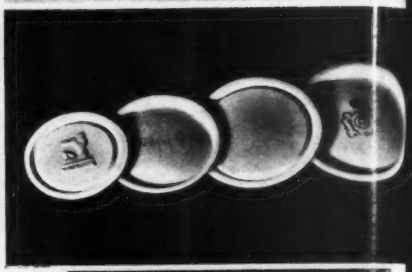
(Left) Cases of welded p.v.c. sheet.

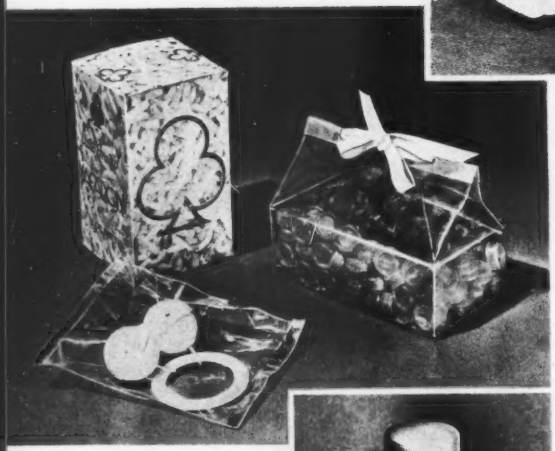
(Above) Hat-box for Jacqmar, Ltd. produced by Chiltern Paper Products, Ltd., using "Celastoid" cellulose acetate sheet, a product of British Celanese, Ltd.

(Right) Case for "Conograph" air brush moulded in black cellulose acetate by British Moulded Plastics, Ltd., for Connor Patents, Ltd.

(Below) Gift pack for "Wyvern" pen and pencil, moulded in black and ivory "Beetle" by Illingworth (Plastics) Ltd.



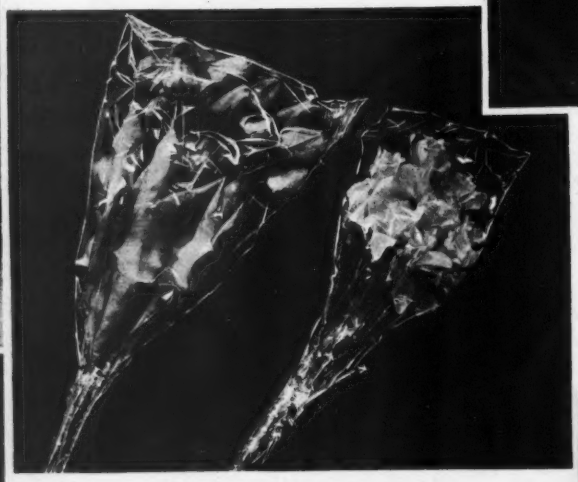




(Left) Group of containers made from "Clarifoil," for packing grocery, sweets and babies' toys. The window-type grocery pack was made by E. S. and A. Robinson, Ltd. (Photo: courtesy, British Celanese, Ltd.)

(Right) This bottle made of p.v.c. by Creators, Ltd., has a metal screw-on closure. Overall height 6 ins., diameter 3 ins., weight of plastic parts 3½ oz.

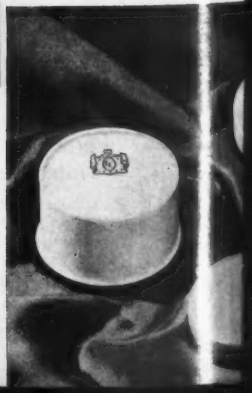
(Right) This "Flexi-Puff" bottle for Atkinson's talcum powder is made of polythene by Cascelloid Ltd. The powder is used by squeezing the bottle.



(Left) Transparent packing flowers is provided by "C phane," regenerated cell film, a product of B Cellophane, Ltd.

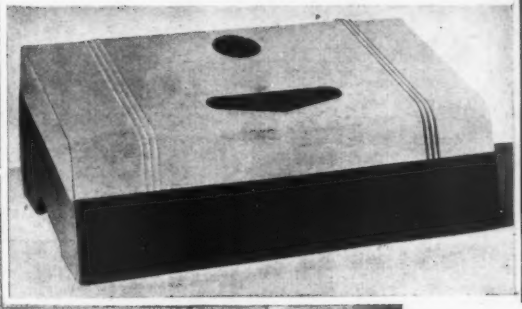
(Left) Cigarette casket moulded in "Beetle" by The Streetly Manufacturing Co., Ltd., for Benson and Hedges (Overseas) Ltd.

(Right) Range of cosmetic containers moulded in "Beetle" by Universal Metal Products, Ltd. (Photo: courtesy, B.I.P., Ltd.)



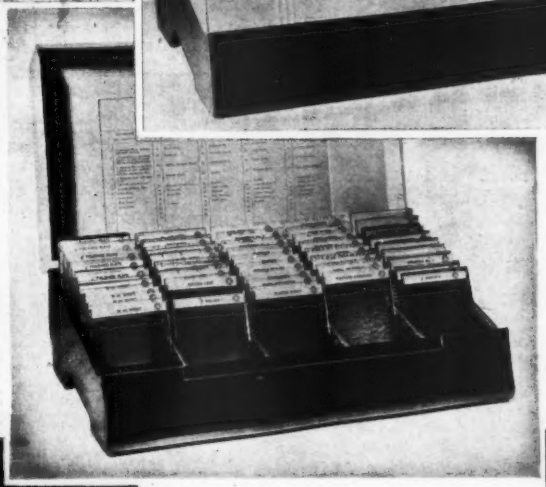
(Left) Cases of welded p.v.c. sheet, for the protection of precision tools, are made by Cascelloid, Ltd.

(Right) Unbreakable polythene bottles, of translucent blue colour, for packing drugs, are made by E. Shipton and Co., Ltd., and distributed by Industrial Appliances, Ltd.



(Left) Cellulose acetate sheet is used for these "Cascaseals" made by Cascelloid, Ltd., which provide protective covers for cosmetic jars.

PLASTICS
February, 1950

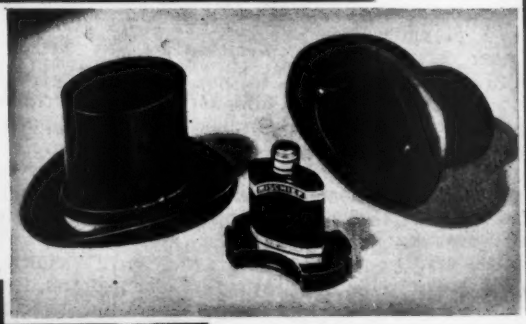


(Left and upper left) Reference cabinet for holding samples of glass, moulded by Ashdowns, Ltd., for Pilkington Brothers, Ltd. The base is phenolic ; the lid, urea. ("Plastics," 1949/May/234.)

(Left) "Resil" pack of resin-bonded fibre, made by Pontefract Box Co., Ltd., as used by British Industrial Solvents, Ltd., for holding bottles containing liquid chemicals.

(Below) Insectide dispenser, of cellulose acetate, by Cascelloid, Ltd.

(Above) Razor set, by Souplex, Ltd., in moulded urea case, with individual tubes for brush, soap, and styptic pencil.



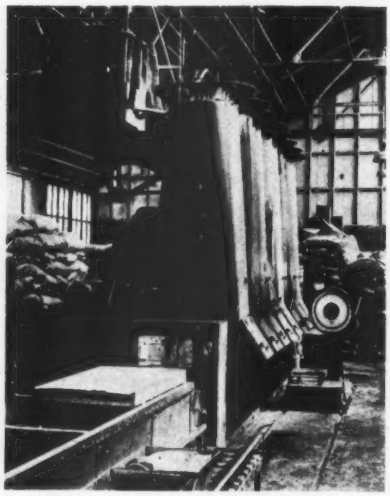
(Above) Top-hat novelty pack, moulded in "Beetle" by The Streetly Manufacturing Co., Ltd. This is one of a series of novelty packs for Saville Perfumery Ltd.

(Right) Powder bowl and talcum powder container by Universal Metal Products Ltd., moulded in pink paper-filled urea.

Ebonite Bobbins Increase Production at Spinning Mills

MOULDED ebonite bobbins are now coming into increasing use in the textile industry following successful trials over two years at various Bolton spinning mills. These bobbins, which have been welcomed by progressive textile managers as a notable step forward to increase production and lower costs, have many advantages over the traditional bobbin.

Made as a one-piece moulding to very fine limits of a tough homogeneous material, the ebonite (hard rubber) bobbin has great shock resistance. It does not absorb oil or water, nor does it crack or splinter. Its use also eliminates mill-marks on yarn, and has no metal parts to chip off to cause a fire hazard. In practice the ebonite bobbins produce better spun yarn and easily stand up to higher spindle speeds, and as a result there has been increased output with lower costs.

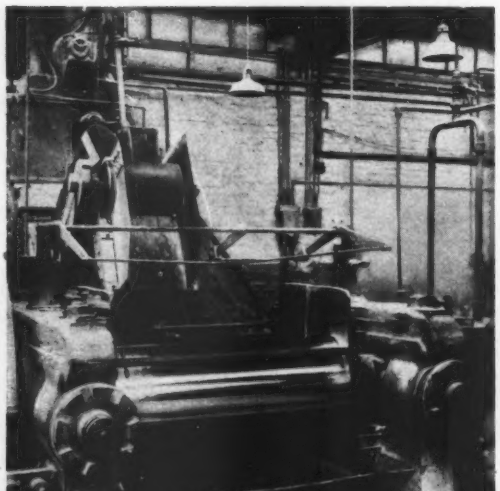


The raw materials for the ebonite mix are taken in weighed amounts from these storage hoppers.

The reason for the incursion into the ebonite field is mainly due to the shortage of wooden bobbins, and losses by breakage. Worried by this shortage of wooden bobbins and breakage losses, managers looked around to find some alternative material in place of wood, incidentally approaching United Ebonite and Lorival, Ltd., to ask if they could make a proposition. After tests on various materials it was decided to use ebonite, and eventually a special compound of ebonite (hard rubber) was developed, which it was thought would not only make successful cardroom bobbins but would ensure better properties than those possessed by the familiar wooden bobbins so long used by the industry.

Several thousands of the new ebonite bobbins were moulded and tried out at a branch of the Fine Spinners and Doublers, the Musgrave Company, Atlas Mills, Bolton, and the manager and his assistants were tremendously pleased with the results. "These bobbins," said the manager, "are a great advance. They have stood up excellently to operating conditions. We have had 10,000 bobbins in use for two years, and 20,000 for a year and a half. Not a single one has cracked, while there have been no losses at all through ordinary cotton-spinning usage."

The Lorival ebonite bobbins have a smooth and homogeneous surface and do not snag or splinter. This is particularly important in cotton or rayon spinning where marks on the yarn are easily caused by oil seeping into any cracks in the bobbin. On the operating side there is greater accuracy in the winding of the roving and a better wind altogether.



General view of part of the Banbury mixer and rollers which produce the mouldable ebonite mixture.

This photograph shows the rubber cylinders prior to the final moulding.

One of the finished ebonite bobbins as made by United Ebonite and Lorival, Ltd.

The bobbins also have a very smooth inner lining to which dust will not readily cling, and in addition they have a true and constant diameter which aids in the winding. Ebonite bobbins run especially true, and are particularly silent in operation, thus lessening mill-room noise.

At first it was thought that static electricity might present some difficulty, but a special conducting agent is incorporated in the ebonite mix and this risk is now non-existent. The moulded ebonite bobbins now being made are much lighter and better altogether than the first experimental ones. It is thought that a great future exists for them.

Ultra Microtomy by New Method

Research Paper RP 2020, by S. B. Newman, E. Borysko, M. Swerdlow, describes a method of obtaining ultra-thin sections of biological materal involving use of polymerized n-butyl methacrylate monomer as embedding media. The solid resin provides an optically clear matrix for cutting thin sections with a slightly modified conventional rotary microtome. Sections having uniform thickness, large area and integrity of tissue structure are suitable for producing transmission images at higher magnifications of light, phase-contrast and for the electron microscope. Metallic shadowing of sections provides greater contrast and a three-dimensional aspect to structural details of tissue. (Journ. Res. Nat. Bur. Standards. 1949/Sep./183.)

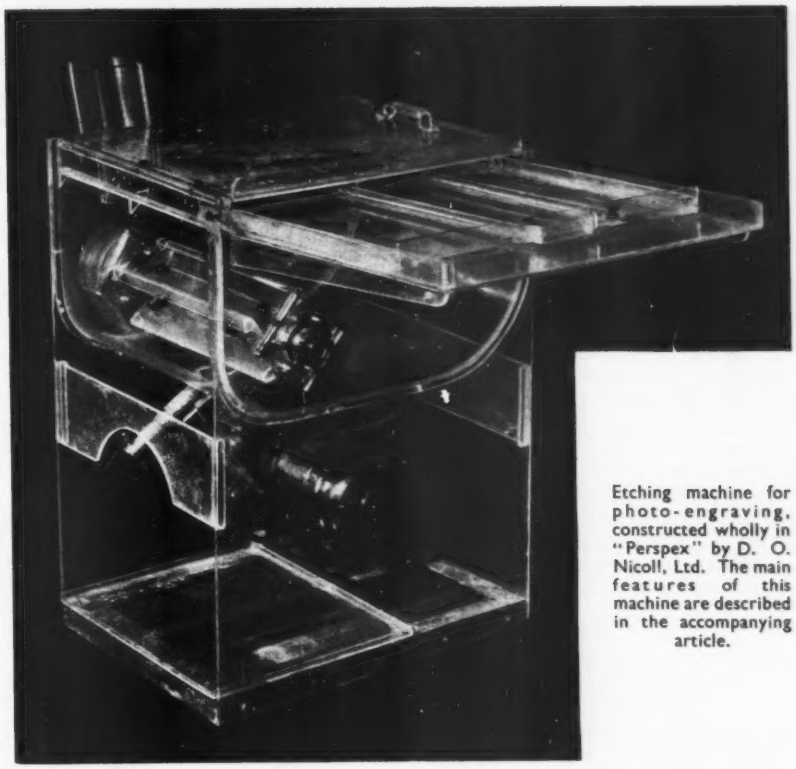
New Etching Machine in "Perspex"

PHOTO-ENGRAVING for the production of metal printing blocks (compare "Plastics," December, 1949) includes many aspects which are virtually chemical processes. One of the important phases is the etching with acid of copper or zinc plates to produce on them the design that has already been developed on the metal surface photographically. The most commonly used etching material is, in fact, iron perchloride, a chemical which is very acidic so that special acid-resisting plant is required for the job.

In essence the etching process consists of holding the metal plates in a frame and immersing them in a continually agitated bath of iron perchloride for predetermined periods proportional to the depth of etch required.

The traditional material used for constructing such plant has for long been glazed earthenware, which, while perfectly resistant to the acid, possesses the disadvantage of great weight, fragility (or the necessity for protecting such fragility), and the fact that it is so difficult to obtain leak-proof glands for the agitator driving shaft. The latter difficulty is a constant source of trouble, rusting of metal parts, and destruction of wood, etc., adjacent to the apparatus being common.

The use of "Perspex" for such equipment was first considered by D. O. Nicoll, Ltd., 50, Britton Street, London, E.C.1, shortly after the war, when this company introduced a plastic tank and fittings mounted on an iron stand. The success of this first model encouraged the designer, Mr. Nicoll, to produce the completely plastic etching plant—the one shown in the photograph has for some considerable time been in use at the works of that well-known concern of photo-engravers, The Engravers' Guild, Ltd., Cursitor Street, London.



Etching machine for photo-engraving, constructed wholly in "Perspex" by D. O. Nicoll, Ltd. The main features of this machine are described in the accompanying article.

The result is a new form, not only permanently covered, with elimination of the traditional hood, but which also permits of the introduction of additions which provide greater safety, greater cleanliness and ease of working. Typical of these is the sliding shelf seen in the top forefront on the fixed tray. On this shelf the plates are loaded into adjustable holders and there firmly locked, the shelf then being slid into the etching machine through the side slot. In this position the metal plate is subjected to the spray of iron perchloride without any possible loss of acid by splashing. Equally the plate can be withdrawn at any stage for observation without stopping the agitator, any acid withdrawn with it flowing from the slightly inclined tray back into the acid tank.

The acid tank itself is provided with curved ends to facilitate the agitation, which is provided by a four-bladed paddle, each blade being perforated along its length with holes to effect a spraying action. It is noteworthy that the gland for the shaft and bearings of this paddle is completely leakproof, as the "Perspex" can be machined to adequate tolerances. Furthermore, the entirely enclosed structure and the method of segregation by use of plastic sheet also permits the protection of the motor from acid splashes.

South African Notes

Many radio firms in South Africa are now making their own sets instead of importing them, and there has been a growing demand for suitable plastic cabinets.

Rens and Co. (Pty.), Ltd., 9, Alexander Street, Johannesburg, are making a new type of plastic licence holder for motorcars. They are also manufacturers of special licence holders for users of motorcycles, caravans and trailers. Other lines being developed by this company are cutting rings for pastry, poker chips and novelties.

Plastics are being used for the moulded buttons made by a Johannesburg firm for men's jacket and trouser manufacturers. Full production was reached some time ago, and the plant is now capable of an output of 50,000 great gross of buttons a year. This is far in excess of the Union's requirements, and the surplus is being exported to the Rhodesias, Nyasaland and Belgian Congo, where sales are increasing steadily.

Custom moulding of plastics is the speciality of a new Johannesburg firm. Plant for injection and compression moulding has been installed. Stock lines include all types of components for electrical fittings, coat hangers, battery tops, and plastic dolls.

Unbreakable plastic articles, ranging from toys to surgical goods, are being made by a concern in Cape Town. The main production is a doll which may be bathed in water up to boiling point, and which can also be taken to pieces and reassembled.

Swan Plastics (Pty.), Ltd., are specializing in Bakelite and urea products, for which the moulds and tools are designed in their own factory. They are also making film developing spools, wheels for toys, electric light shades, switch guards, ten-way distribution boxes for the telephone service, two-pin plugs, coil formers for short-wave converters, and covers for Heineman circuit breakers.

Most of the raw materials used by the plastics industry in South Africa have to be imported. At the moment, manufacturers have good stocks and expect to obtain import permits for adequate quantities.

Thermoplastics for Temporary Mechanical Protection of Materials and Equipment

By E. E. HALLS

GLANCING back over the past 20 years, and particularly over the last decade, reveals an astonishing advance from infancy to maturity—and almost of supremacy—of the synthetic plastics in organic finishing media—paints, varnishes, lacquers, enamels, inks, etc. This is particularly emphasized in industrial finishing, where coatings are required for decorative purposes in general, for protection of metal work against corrosion, for electrical properties on non-metals, such as plastic products, rubber and ebonite, fibres, etc., and for moisture resistance. Metal, timber, plastics, paper and card, glass and ceramics; practically all materials for one reason or another, at one time or another, receive an applied finish. As the basis of such finishes, nitrocellulose, cellulose acetate, amino resins, phenol-formaldehyde products, vinyl resins, polystyrene, silicones, etc., have all established rôles, major or minor, for purposes general or specific. All this has been achieved without any dislocation of industry, in complete harmony with the rapid development of finishing equipment and methods. Processes of application by brush, dip, spray, "swilling," whirling, roller-coating and printing have been fully satisfied. Conditions of air drying, forced drying and stoving have been met, and the needs of steam, gas and electric heating, by convection or radiant heat plants, stationary or conveyorized, have been fulfilled. The use of better finishing media, manufactured under more controlled conditions, to closer specifications, has been made possible by the development of synthetic plastics. The result has been better finishes produced more economically.

It is quite logical that in this field of finishing, not only industrial but also utility, domestic, etc., the synthetic resins should enter and take control. There is, however, an allied sphere in which plastics have made their inroad in a very positive manner, namely, that of packaging. Materials, components and equipments have to be wrapped, boxed or crated for various reasons—for transport, for storage, for preservation, or for display. Plastic film materials claim a large share of the material needs in this direction. Regenerated cellulose, cellulose acetate, rubber hydrochloride ("Pliofilm"), ethyl cellulose, polyvinyls, are extensively used as packaging films, not merely as simple film material but in corrugated, built-up corrugated, and similar forms. The extreme of this art of packaging for preservation is illustrated by the "Cocoon Technique" (see "Plastics," August, 1947), in which equipments small or large are "spray-packed" in a vinyl plastic in such a manner that they can be fully protected against rusting, loss of electrical insulation or other form of deterioration, even when exposed to open-weather conditions for long periods. In this "cocoon" process, just a fibrous web of polyvinyl plastic is applied and then a thick film of the same material is built up in order to seal the article.

The present subject concerns the use of plastic coatings for the temporary mechanical protection of raw material, components and equipments. Its scope lies between the two fields of industrial finishing and packaging just illustrated, but in some senses it overlaps them, as will become apparent. Mechanical protection represents a relatively new field for plastics, in which they efficiently serve a purpose that cannot be satisfied, or not easily satisfied, with other materials. In many cases this type of protection is revolutionary because it avoids damage and loss, whereas previously the damage had to be tolerated or corrected and the loss sustained.

The need for mechanical protection can be best envisaged in the first instance by considerations of raw material, taking as examples metals and non-metals.

Metal sheets may be produced from the final stages of cold rolling in almost perfect surface condition, particularly the coppers, brasses, aluminiums and stainless steel. The latter may additionally be polished. For transport, these materials are properly packed by interleaving with paper, and casing. At the customer's end, they are unpacked upon receipt for inspection, and passed to store. From the latter they may gradually be drawn into the machine shops for fabrication, the components made therefrom "finished" in appropriate fashion, and finally assembled.

Source of Scratches and Surface Defects

It is generally recognized that there may be several stages of storage of semi-finished and finished components before final assembly. It becomes immediately apparent that there is ample opportunity for mechanical damage to surfaces which, in the raw-material stage, started life in an almost perfect condition. Scratches and indentations can be caused as follows:—

(a) From slight lateral movement between the sheets in transit, especially if a litttle gritty dirt is allowed to enter.

(b) From handling, however careful, during unpacking, inspection and transport.

(c) During issue of the material to the machine shops, by sliding one sheet over another, even if interleaved with paper, and whether packed vertically or horizontally.

(d) During machining, in "lining-out," from swarf on the machine bed, or between the sheets or parts, and from general handling.

(e) During passage by trucking from one operation to the next, or during storage awaiting the next operation.

There are a thousand and one articles where slight surface damage is of little consequence, and in which it causes no deterioration, involves no additional finishing operations for correction and no added expense of production. The present problem, therefore, does not refer to work of this category. It does, however, refer to all items of "face equipment" and to any others that, on the final job, must look neat and attractive. It includes all cases where damage accidentally caused must be corrected by machining, polishing or filling during finishing.

For this class of metal sheet, a finish is required to safeguard the material from mechanical damage in its circuitous passage from the raw material manufacturer to the finished job. Preferably it needs to be applied by the supplier; alternatively, it may be applied by the receiver immediately the material is unpacked. Requirements of the final job can dictate whether the finish should be applied to both sides, or to one surface only, of the sheet.

Appropriate finishing media are available for this class of mechanical protection. There is also a requirement of a more rigorous nature, namely, for a temporary protective film for metal sheet, strip, etc., that will withstand press operations of bending or forming, and pressing or drawing. This, too, is practicable, so that polished stock can be safely employed to minimize polishing effort on the final component.

The non-metals can most aptly be represented by plastic materials. The Bakelite laminated sheets (synthetic resin-bonded paper, fabric, asbestos and glass sheets), the amino sheets, and the combination boards of the "sandwich" variety

(urea-faced phenolic core, or urea-core phenolic-faced materials) are an example of the hardest materials of the group, yet they very easily become marred in the interval between manufacture and usage, for one or other of the reasons already listed. Mechanical damage to the surfaces of these materials is very difficult or impossible to correct because of the laminated structure, i.e., the polishing-out of scratches nearly always results in a mottled pattern due to cutting through the laminæ. As many of these materials, particularly the urea and sandwich boards, are employed in applications where surface condition, colour, polish and uniformity is of primary importance, it is imperative that damage is not permitted. All such material destined for use of wall boards, furniture, panellings, instrument panels and mounting plates, designation strips and labels, etc., must therefore be given every protection possible until it is ultimately assembled in position.

Other plastic sheet materials may be even more easily damaged than are these thermosetting materials. Cellulose acetate and methyl methacrylate ("Perspex") are the commonly troublesome ones. As these materials are often destined for use as "windows" or graduated dials, it is evident that their surfaces must not be marred or their transparency (or translucency) impaired. Again, the methacrylate resin is used for mirrors and lenses, and for "piping" light in many ingenious remote-control systems. In these applications it is important that no surface damage occurs. Other materials could be enumerated—ebonite, glass, metal- and plastic-coated plywood, marble composition sheets, etc.

Need for Protection of Components

Turning to components, a little more may be usefully added. Various small tools, such as cutters, have important edges to protect from mechanical damage, as well as from corrosion. The teeth of precision gears need to be protected. There are too many very small instrument parts that need protection for transport, etc., and for these some form of bulk treatment is preferable, and certainly more economic than individual packaging. In the non-metallic group, ceramic (including earthenware and china) and glass articles may require protection from surface chipping through a lengthy period of handling; there may be machine operations, such as grinding, to be performed.

Materials and components have been discussed as such, but "finished"—and particularly "metal-finished"—components have not yet been specifically discussed. In this group is included enamelled and electroplated work, especially panels and cabinets, which cannot be finished and shipped away directly to the customer. All items that have to be equipped are included, and the electrical industry is probably the one most concerned. The front panels and cubicles of signalling equipments, switchgear, power boards, remote-control apparatus, and of telephone and radio apparatus or equipment in general are typical examples. These are usually neatly finished with high-class enamels, not only for protection, but also to provide an overall æsthetic colour scheme to fit that of a complete installation. An appreciable time period usually elapses between the initial finishing of the component parts of the equipment—panels, cubicles, frameworks, etc.—and the shipment of the equipment after final assembly, functioning tests and inspection. Much handling, transport to and from store, or from one section of the factory to another, occurs in this period. Fingermarking, chipping and scratching of the finish inevitably occurs; much refinishing or "touching-up," or both, results, and the final job is often a poor reflection upon the quality intended. Repeatedly, equipment engineers ask for the development of a "strippable" finish that can be applied to the vulnerable areas of the panels and the shell of the structure, in the finishing shop, over the specified finish. This can be peeled off immediately before shipment or after shipment and installation on site. The second of these suggestions is to be preferred, because the same strippable finish makes packing easier.

The foregoing has been a sketchy presentation of the problem, an abbreviated survey of the materials, components and industries involved. It is hoped that sufficient has been given not only to incite interest, but also to create action and to promote further development in useful directions. Materials are available, and have already been extensively employed, in many directions successfully. Material damage has been avoided, loss of valuable production time has been avoided, unnecessary expense has been saved, and avoidable delivery delays overcome. Extended use of these established materials and techniques is required in order to foster developments for the more complete solution of these and wider problems.

Requirements of the Protective Film

A protective film has to be provided for the work in question, and it would be informative to examine some of the requirements for this, viz.:—

(a) A material that is readily available and inexpensive.

(b) A material involving a simple technique for application, preferably using established methods and plant, and without introducing undue fire risks or health hazards.

(c) A material introducing no corrosion hazards to the materials upon which it is applied.

(d) A material causing no solvent action or other deleterious effect upon thermoplastic materials, enamel finishes and the like to which applied.

(e) A material that lends itself to application in controlled thickness, and without the need for this thickness to be excessively great.

(f) A material that can be rapidly, easily and economically removed when it has fulfilled its function.

(g) A material yielding a film of correct mechanical properties, i.e., sufficiently elastic to deform without rupture, strong enough to withstand impact shock and scratching without destruction of the film.

(h) A material providing a film that possesses a degree of adhesion appropriate to the duty it has to perform.

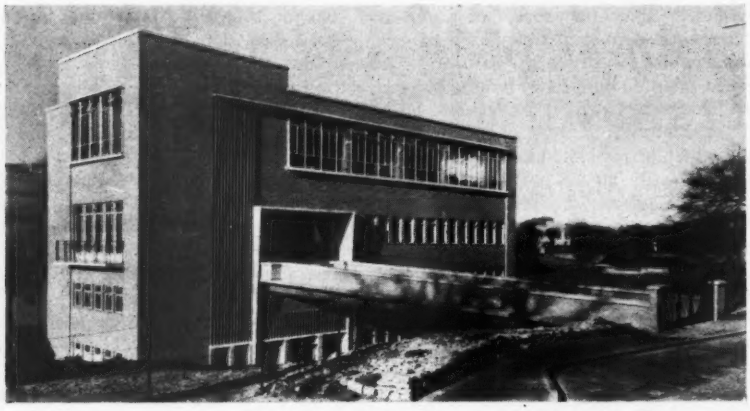
(i) A material that provides mechanical and physical protection without impairing or hindering other operations that have to be performed.

(j) A material which, once applied, is stable for the period of time required and under the exposure conditions that may be encountered.

Never can an ideal be fully realized in practice, and the present application is no exception to the rule. In point of fact, a single material is very unlikely to satisfy all the requirements in all the varied applications concerned. In America, two forms of plastic composition have been exploited in this direction. One of these is the hot-melt type, comprising a thermoplastic base suitably plasticized, and its application is by hot dipping. The second uses a thermoplastic in solvent solution, the composition being applied by dip or spray methods, or even by brush or roller-coating. In this country, both of these formulations are available. The hot-dip type is a plasticized ethyl cellulose composition, and the solution type is a polyvinyl resin solution. In addition to these, however, solvent solutions of the metal naphthenates have been, and are being, used in this field of protection and, apart from general utility, they have proved themselves to possess special merit in certain cases. In the following instalments information upon the American materials will be presented with parallel data from practice in this country, together with the metallic naphthenate processes which, as far as is known, have only been developed here.

(To be continued)

New Research Laboratories for Erinoid



THE rapid growth in the volume of material produced at the works of Erinoid, Ltd., Stroud, and the increase in the variety of products handled, made the provision of greater laboratory accommodation necessary in order to provide adequate routine control and to pursue essential research and development programmes.

The site is extremely congested, and, consequently, it was necessary to build a four-storey building to accommodate the floor area required. The level of the site is approximately 25 ft. below the adjoining road, and a bridge has been built to provide easy access from the main road.

The two large laboratories, routine and research, are housed on the top floor, so that they will receive maximum amount of light. The two smaller laboratories, physical testing and special research are on the lower storeys. The building also provides a reference library, samples room, a large conference room, dark room, etc. The basement has a special laboratory devoted to colour matching, and there is a large section with considerable headroom to house semi-technical plant.

The routine control laboratory, situated on the top floor, is provided with wall benches supplied at suitable points with the essential services, namely, water, electricity, gas, compressed air and vacuum. Central benches with similar services are fitted with central reagent shelves, commodious cupboards and drawers, and run at right angles to the larger window, thus ensuring plenty of light along the length of each.

The layout of the main research laboratory is similar to that of the routine laboratory but is considerably larger. The routine control laboratory is designed for the testing of all raw materials, and examination and testing of finished products, whilst the main research laboratory is intended for the carrying out of work in connection with the improvement of existing products and the initiation and development of new processes.

The physical testing laboratory on the ground floor has been especially planned for the housing of apparatus for the physical examination of the company's products.

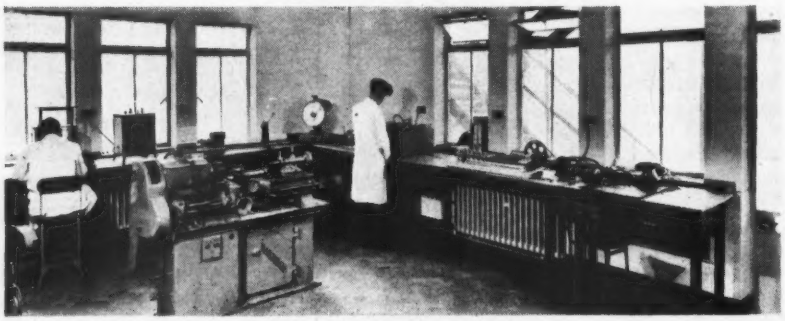
Only wall benches are provided, the centre being occupied by a small lathe and a high-voltage cabinet, the latter being for the testing of electrical breakdown strength of moulded material.

The basement is taken up by the semi-technical laboratory and the colour laboratory.

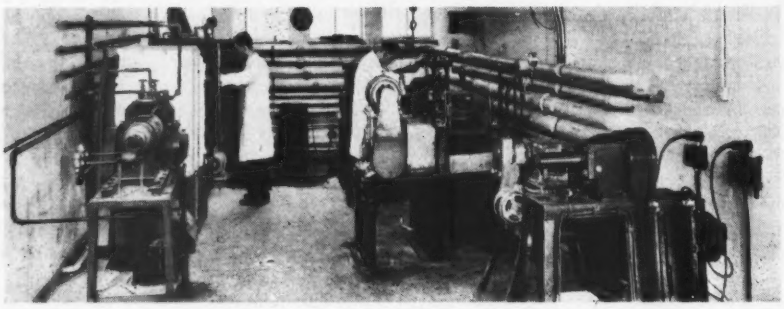
The former has, over the greater part of its area, been given greater height, 24 ft., to allow for the erection of experimental plant and to ensure more ventilation.

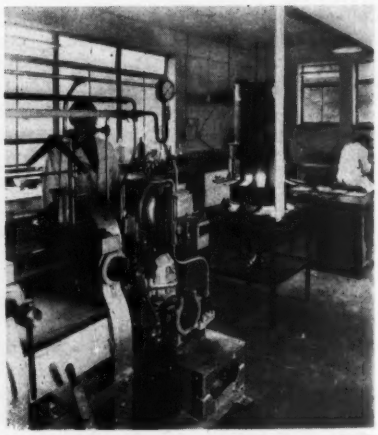
The laboratory is equipped with hydraulic presses, extruding machines, injection moulding machines, mixing machines, hot mixing rolls, vacuum and steam ovens as permanent equipment, whilst a considerable space is left for the erection of small-scale plant in development work.

Provision is made for the supply of high- and low-pressure steam, ample electric power at 220 and 440 volts, and large water mains ensure adequate water for cooling purposes.



(Above) Physical testing laboratory.





(Above) Colour laboratory.

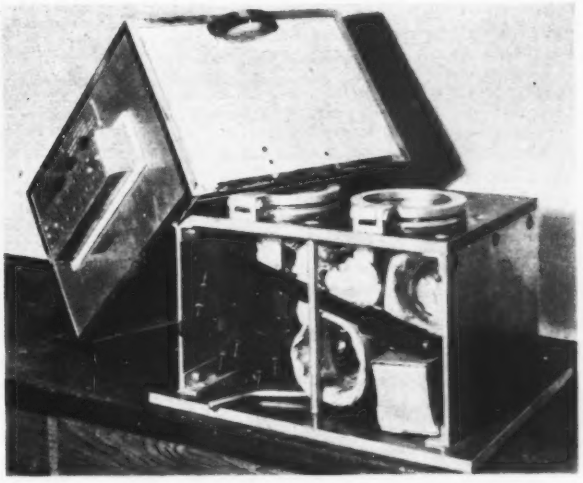
(Left) Semi-technical laboratory.

Demonstration Unit for "Perspex"

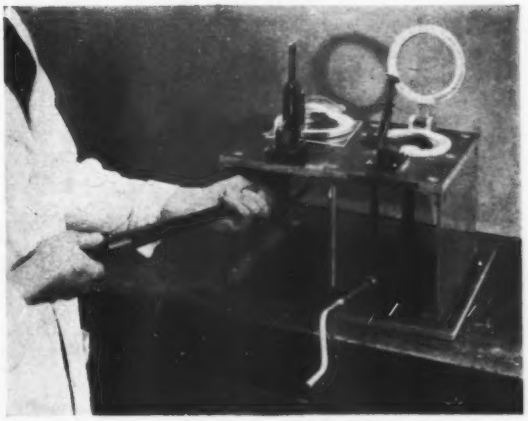
IN those parts of the world where engineering facilities are rudimentary or are non-existent, the need has often been felt for a means of demonstrating methods of fabricating "Perspex" acrylic sheet. The unit illustrated was designed and constructed by the Technical Service and Development Department of I.C.I. Plastics Division, so that techniques could be easily demonstrated, even in a workshop or an office in any part of the globe.

The unit consists of an oven operated by infra-red lamps, and a work bench on which are mounted two clamping rings, one for demonstrating the forming of heated "Perspex" by blowing, and the other to demonstrate the manufacture of articles by deep pressing. The operation of the unit is dependent only upon electrical power being available for heating, since the compressed air is supplied by a hand-operated cycle inflator, and the thrust for the demonstration of pressing is obtained from an automobile jack.

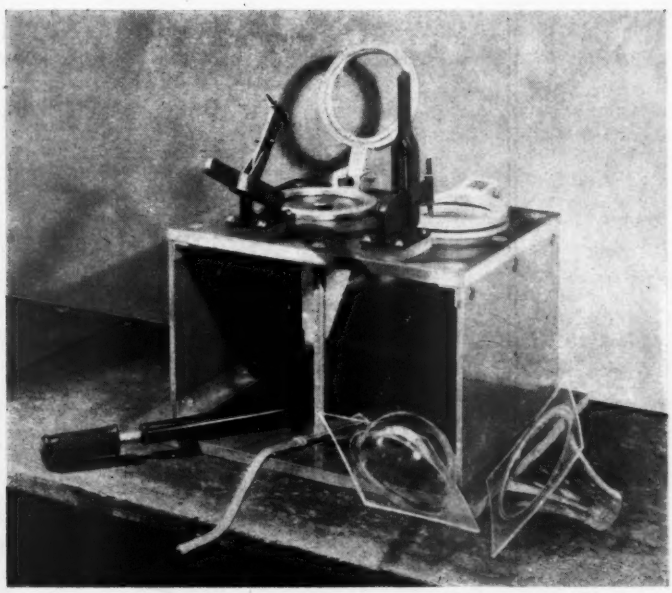
For easy transport, the components are packed neatly under the work bench and the oven is inverted to form a cover. A light-weight kit of tools is supplied to extend the demonstration to include simple forming over a wooden mould and the cutting and cementing of "Perspex."



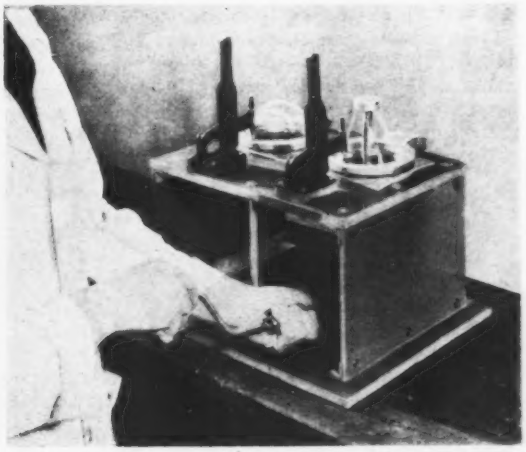
The oven removed, to show components neatly packed under the work bench.



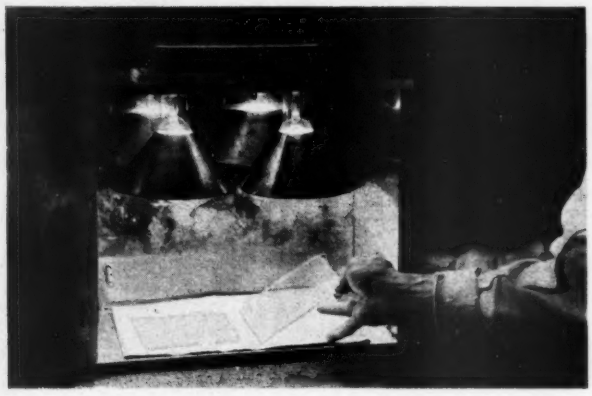
(Above) Blowing a dome shape by use of the cycle inflator.



(Left) Work bench, with clamps erected in readiness for demonstration. In foreground: examples of blowing and deep pressing.



(Above) Making a deep pressing by use of the automobile jack.



(Left) Using the oven, which is heated by a battery of infra-red lamps.

LETTERS TO THE EDITOR

Correspondents are reminded that a stamped and addressed envelope should be enclosed in all cases where a personal answer is desired. It is understood that any letter received may be published at the discretion of the Editor.

Plastic Mallets

Sir,—With reference to the letter in the December issue of "Plastics," asking name of maker of mallets with a 2-lb. solid head of plastic, as we make these we have communicated direct with the inquirer. It is of interest to add that a solid piece, 3 in. in diameter by 6 ins. long, weighs about 1½ lb. in polythene or 2 lb. in p.v.c., celluloid or laminated plastic.

For many purposes a solid head of plastic is ideal, but on other jobs it is too bulky or too expensive. In these cases we fit plastic faces screwed into either an aluminium or a steel hammer-head. Besides being instantly replaceable when worn, these screw-in plastic faces can be supplied in any of the suitable plastics, hence a dual-purpose hammer with one face, say, of soft polythene, and the other of hard laminated plastic, will give two different types of blow.

Hammering needs, however, are so varied that there is no one plastic which will suit all jobs, but we consider that polythene is the best plastic for general use.

THOR HAMMER CO.
Salop Street, Birmingham, 12.

Protection for Architectural Metalwork

Sir,—We are at present fabricating a contract in anodized aluminium, comprised of both cast and extruded sections, and when completed and fixed our work will need protecting for several weeks pending the official site opening.

We shall therefore be pleased to learn if you can recommend a plastic film process which can be applied by a spray-gun, and which will protect the finish of the metalwork during handling, also against atmospheric conditions. It should, of course, be possible to easily remove this film, or deposit, when required.

H. H. MARTYN AND CO., LTD.
Sunningend,
Cheltenham.

Heat Welding for Polythene

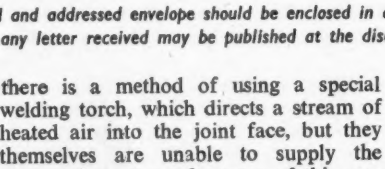
Sir,—We have received an inquiry from our associates in Argentina, Merex Argentina S.A., on the subject of the welding of polyethylene bags. It appears that they have a client who is interested to purchase suitable equipment for heat welding a quantity of 500,000 bags, and in this connection we have already written to our principals, Delapena and Son, Ltd., who have suggested that you may be in a position to supply information with regard to manufacturers of this type of welding equipment.

We understand from Delapena that there is a method of using a special welding torch, which directs a stream of heated air into the joint face, but they themselves are unable to supply the names of any manufacturers of this particular equipment. We should, therefore, be obliged to hear whether you can assist us in this matter.

SYDNEY HARVEY (EXPORT), LTD.
29, Mincing Lane, London, E.C.3.

Plastic Bait for Fishing

Sir,—We shall be glad to contact a firm who can undertake the manufacture of plastic "bait." The enclosed sample



relates to one type of bait only, and is sent to give some idea of our requirements. W. MARTIN JAMES, LTD.
Redditch.

Sugar as Plastics Raw Material

Sir,—I have just seen the November, 1949, issue of "Plastics" containing the letter of G.M.A., of Manchester, asking whether sugar has been used in plastics manufacture.

I believe the following publications will be of interest to your correspondent. They are available free, upon request, from The Sugar Research Foundation, 52, Wall Street, New York, N.Y.:—

Long, "Sugar and Sugar By-products in the Plastics Industries." Scientific Report No. 1, April, 1945 (Technological Series No. 5, issued January, 1949, is a revised edition of this report).

West, "Utilization of Sugar Cane Bagasse for Paper, Board, Plastics and Chemicals." Scientific Report No. 3, March, 1946, and Supplement, April, 1949.

Guttag, "Patents on the Reactions of Sugars." Technological Series No. 1, May, 1947. (This is a digest from the files of the United States Patent Office, and only includes those British patents which do not find American counterparts in the plastics field. ALVIN GUTTAG.
717, Chillum Road,
Chillum, Maryland, U.S.A.

Plastic Watch Glasses

Sir,—We are in need of transparent plastic sheets or celluloid sheets for manufacture of watch glasses.

RAHMAT ULLAH AND SONS.
14, Anarkali,
Lahore.

[EDITOR'S NOTE: The sample is of celluloid, 25 thou. thick.]

Polyvinyl Acetate

Sir,—We are at the present time extremely interested in obtaining supplies of polyvinyl acetate; in particular, those of molecular weight similar to "Gelva 15" and "Gelva 1½," as manufactured by Shawinigan, of Canada.

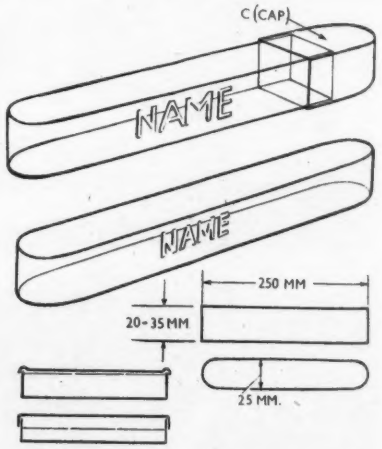
We feel sure that the patent position of the manufacture of this material must now be cleared up; we do know of one manufacturer who is making this material, but, unfortunately, this is only supplied in the form of solutions in various solvents, whereas our particular requirements are for the material to be in the dry powder form. We would welcome any suggestions and names and addresses of firms who might be able to help us in this matter.

"POLYVINYL."

Transparent Containers

Sir,—Clients of ours require capsules (casings) made of transparent plastic. These capsules, made of two pieces as per sketch, will serve as containers, and should be easily closed by the cap "C" by slipping it on the container proper. The total length of the capsule, including its cap, when closed, should be 10 ins. The length of the cap will be about 3 ins., covering 1-in. length of the container. Each capsule should have an inserted (pressed) name.

The client would pass a trial order of about 25,000 pieces, to be delivered in one or two shipments.



We should be obliged if plastic manufacturing firms would submit us their offer at their early convenience.

Any useful suggestion, with regard to the cover or mode of closing the capsule, would be appreciated.

R. G. HOCHSTEIN AND A. E. HOCHSTEIN.
Alexandria (Egypt), P.O.B. 1233.

New Productions in Plastics

Suction Cleaner Parts

Two of our illustrations on this page show how Hoover, Ltd., are using moulded parts in the construction of the " Hoover " cleaner Model 612.

The motor hood is compression moulded in a shock resisting material on a 200-ton press. Two parts are produced together in a cycle time of 4½ minutes. The hood, in addition to being a design feature of the cleaner, also has the function of completely shrouding the motor casings, dirt finder lamp and electrical leads. This is to preserve these parts from damage which might result from knocking against furniture, and to protect the user from electric shock, or injury from moving parts such as the motor cooling fan.

In this particular use, moulded " Bakelite " has (in the words of Hoover, Ltd.) a satisfactory texture and is economically moulded into suitable forms to interpret the designers' intentions. The demands of functional design are satisfied by the following properties: Lightness in weight, rigidity of form, resistance to impact, electrical insulation, and permanent colour which will not scratch or rub off.

The motor cases are compression moulded in a general purpose material on a 200-ton press. The top casing is produced by a three-impression mould in a cycle time of 4 minutes; the bottom casing, likewise using a three-impression mould, in a cycle time of 5 minutes. The purpose of the motor cases is only functional. They locate the various motor parts, such as bearings, armature and field core, relative to each other, and they hold the motor rigidly in position in the cleaner. In this case the following properties of " Bakelite " are utilized: Good electrical insulation, low water absorption, dimensional stability within the required temperature range, lightness in weight, and consistent and accurate reproduction of a complicated part having several location points which must occupy their correct relative positions is economically attained.

Three-piece Cruet

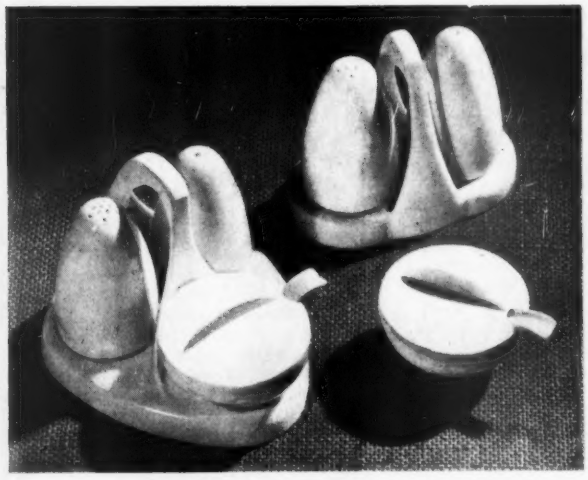
When " Beetleware " was redesigned immediately after the war, the condiment pieces were obtainable either entirely separately or with the salt and pepper shakers contained in a two-piece holder, the mustard pot being separate. A logical development was the designing and production of a three-piece condiment holder, which is now in production. It is not by any means intended to replace the two-piece holder, but simply offers the alternative of a compact single unit for those who prefer it.

In appearance, the new three-piece unit has borrowed much from the two-piece unit, thus keeping it in character with the pleasantly rounded contours typical of " Beetleware " table pieces. It balances naturally when held between thumb and fore finger by the top of the holder, and the condiment containers fit easily yet firmly in the cavities provided. Its shape suggests strength and solidity; colours are blue, ivory, green and orange.

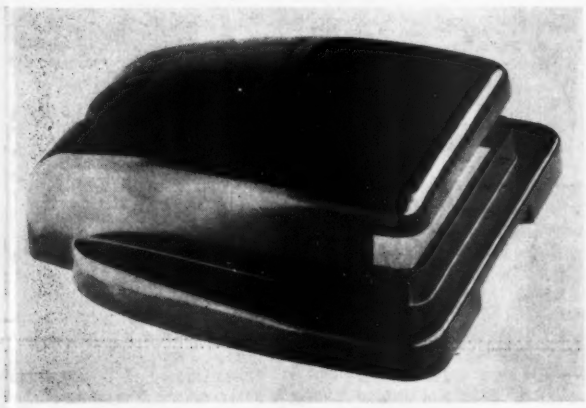
This three-piece cruet is moulded by the Streetly Manufacturing Co., Ltd., using urea-formaldehyde moulding powder supplied by the Beetle Products Co., Ltd., 1, Argyll Street, London, W.1. It is interesting to note that the black screw-on bases of salt and pepper units are recessed and have a vertical flange for easy removal and replacement; one complete turn only is required to unscrew bases.

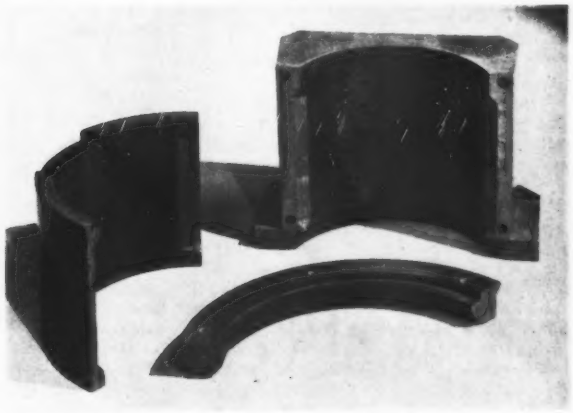
Bearings for Steel Mills

The Bushing Co., Ltd., of Hebburn-on-Tyne, recently sent us some examples of their " Texolex " laminated fabric moulded bearings as used in steel rolling mills. Three examples are here illustrated. Used in steel mills such bearings offer the advantages of water cooling, low coefficient of friction, longer life than metal, and freedom from injury to the roll necks. An article on synthetic resin bearings as used at steel mills has already been published in " Plastics " (May, 1947, page 367). A further article (October, 1947, page 516) dealt with the lubrication of plastic-bonded fabric bearings.

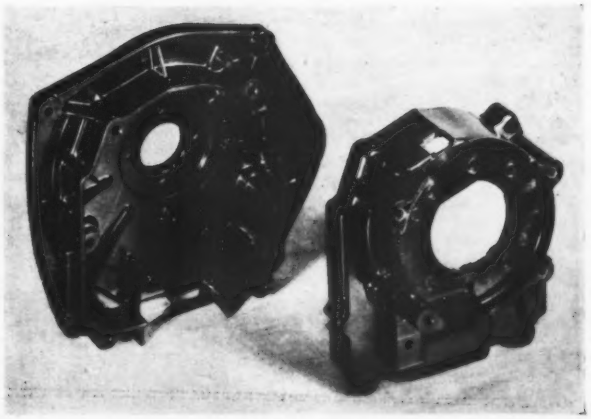


Three-piece (and two-piece) cruet.





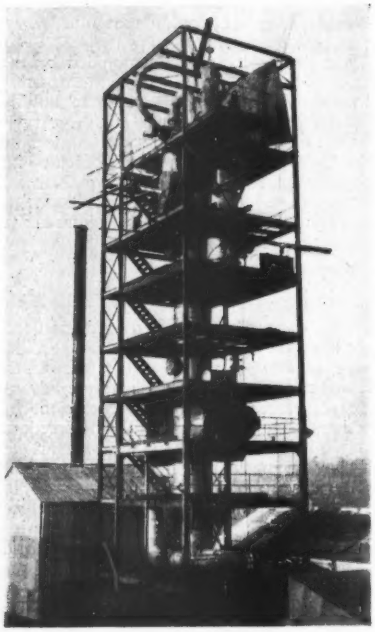
Bearings for steel mills.



(Above and left) Suction cleaner parts.

PRODUCTION NEWS

Raw Materials, New Plant, Works Organization, Control Apparatus, Research, Personal and Trade Notes

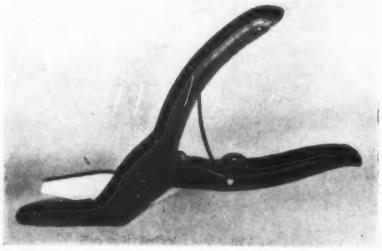


FATTY ACID DISTILLATION.—A new plant at Littleborough in Lancashire, erected for Hess Products, Ltd., 4, Albion Street, Leeds, will distil fatty acids by a fractionation process, producing commercial quantities of fatty acids of hitherto unobtainable purity which will be marketed under the trade name of "Distec." The patent rights of the process have been acquired from Armour and Co., of Chicago, who are pioneers in the field of fatty acid development. The plant is essentially a series of fractionating columns operating under high vacuum, steam being injected as desired to assist close fractionation and reduce operating temperatures. Heat transfer is by means of diphenyl vapour, for which a 6-million B.Th.U. diphenyl boiler is an initial installation. Our illustration shows the main distillation structure, with part of the Dowtherm boiler house, pump house and control room. The products of the plant include saturated and unsaturated fatty acids. The saturated acids can be produced up to 90 per cent. purity, including all even carbon chain lengths from caprylic to stearic. Lauric acid (90 per cent.) is particularly valuable in plasticizers for synthetic resins. The unsaturated acids will be fractionated into groups of different carbon chain length, some of which enter the field of alkyd resins.

TRADE NAMES.—In their Information Bureau Circular No. 372, the Research Association of British Rubber Manufacturers publish an "Annotated Comprehensive List of Trade Names of Synthetics." The list is compiled from a search of journals, books and trade name lists in the R.A.B.R.M. library of plastics and rubber literature. With over 7,800 listed trade names it claims to be the most comprehensive list so far published in this field. Where possible the information given beside the name includes the nature or chemical composition of the synthetic, the form in which it is available, and the name and town of the manufacturer. Copies may be obtained from the Association at a price of £2 2s.

PLASTICS IN BRAZIL.—British exports of plastic materials to Brazil are likely to be affected by the expansion of local manufacturing activities. The Companhia Nacional de Tejidos Nord Americana was recently formed, as a subsidiary of Vulcan S.A., in Rio de Janeiro, to establish the first Latin-American plant for the manufacture of p.v.c. sheet. The Bakol, S.A., of Sao Paulo, which last July started the manufacture of polystyrene, is also the first plant of its kind in Latin America. Technical advice in both cases is being given by the Bakelite Corporation, New York.

STRAPPING CUTTER.—Most manufacturers make use of tensional steel strapping (either wire or band) to reinforce packages containing their products, and the recipients of packages often have to resort to some makeshift arrangement to sever this strapping. The "Gerrard" strapping



cutter, introduced by Gerrard Industries, Ltd., Harlequin Avenue, Great West Road, Brentford, Middlesex, has been specially designed for this purpose; its tapered blade slips easily under the strapping, which is then severed by an easy lever action. The blade, which is capable of severing band up to ¾ in. width, has a slot making it possible also to cut wire up to 13 gauge.

REORGANIZATION OF BOARD OF TRADE.—The home side of the Board of Trade is reorganized as from January 16, 1950. The principal aim of this reorganization is to reduce the number of Divisions in the Board with which a single industry or firm has to deal. Each raw material is now being dealt with (as far as possible) by the same Division as the industries which consume that raw material. For example, furniture is in the same Division as timber. This means that the Raw Materials Department and Priorities Division will disappear as separate entities and their functions will be merged in the industrial work of the Industries and Manufactures Divisions.

TRADE FAIRS AND EXHIBITIONS.—The Board of Trade announces that Sir Gerald Campbell, formerly H.M. Minister in Washington, has accepted an invitation from the President of the Board of Trade to make a special intensive study of trade fairs and exhibitions in the U.S.A. and Canada. During his tour of about two months he will consider not only the regular fairs and exhibitions already established and open to British exporters but also the possibility of arranging special exhibitions or display centres for British goods.

NATIONAL PLASTICS EXPOSITION, to be held in Chicago, March 28-31, will include a huge display of more than 100 case histories of industrial and commercial uses of plastics. Simultaneously with the Exposition, the Society of the Plastics Industry will sponsor a conference at which distribution, merchandizing, marketing and selling will be discussed. The conference's central thought will be that plastics have a decade of opportunity during 1950-1960.

PLASTICS IN GERMANY.—A British commission of experts has, according to the "Frankfurter Rundschau," declared that the plastic material manufactured by the Bayer Works at Leverkusen (formerly one of the foremost units in the I.G.), named "Vulkollan," belongs to the group of Buna products, manufacture of which is not permitted in Germany. Tests made with "Vulkollan" had shown that it is particularly suitable as a leather substitute.

HIGH VOLTAGE INSULATION.—Mr. F. C. Walmsley, of The Micanite and Insulators Co., Ltd., delivered a lecture entitled "Laminates applied to High Voltage Power Plant" to the Midland Section of the Plastics Institute of the James Watt Memorial Insitute, Birmingham, on December 16. The application of insulation, particularly to transformers and switchgear, was examined and discussed. A wide representation of plastic's technicians and electrical engineers from companies in the Midland area subsequently adjourned to a reception, which offered opportunity for a further exchange of experiences and a renewal of acquaintances.

MATERIALS FOR RADIO INDUSTRY.—The Radio Industry Council has issued a specification (RIC/1000/A) dealing with the "choice of materials for radio and other electronic equipment, and for components therein." In addition to metallic materials, textiles, paper, timber, etc., the specification covers the complete range of plastic materials used in the industry under the headings: thermosetting plastics, thermoplastics, elastomers, wire coverings and synthetic resin adhesives.

This is a private specification published for the use of the British radio industry and has not yet reached the stage of consideration by the British Standards Institution. Full references are given to relevant specifications of the Ministry of Supply and the British Standards Institution.

PRINTED CIRCUITS have become a practical technique for mass production of electronic devices. As a result of increasing interest in this rapidly developing electronic art, a technical symposium was held in the United States in 1948 by the Aeronautical Board's Aircraft Radio and Electronics Committee, under the technical supervision of the National Bureau of Standards, when 22 papers were presented on the status, applications and limitations of printed circuits. The proceedings of this symposium have now been published in "New Advances in Printed Circuits" (NBS Miscellaneous Publications M.192) which is obtainable from the

Superintendent of Documents, U.S. Government Printing Office, Washington, 25, D.C., price 40 cents per copy.

Topics presented by representatives of industry and Government laboratories include the status of printed circuits; conductive silver preparations, printed resistors; trends in military communication; vitreous-enamel dielectric products; printed electronic components on glass, plastics, and other non-conductors; imprinted circuit inlays; spraying techniques; mechanization of electrical wiring; die-stamped wiring; and typical commercial applications. The booklet concludes with a summary of the subject and a discussion of the important technical questions raised in the symposium.

The section on electrical circuits on plastics and other non-conductors (five pages), a contribution from Metaplast Co., Inc., of New York, is by Charles E. Marlies, Associate Professor of Chemical Engineering, The City College, New York.

FURNITURE DESIGN.—The high standard of contemporary design which furniture manufacturers are setting for the Festival of Britain will be demonstrated by photographs of furniture accepted for the 1951 "Stock List" and displayed on the stand of the Council of Industrial Design at the first post-war British Furniture Trade Exhibition, at Earls Court, London, February 14-24.

LAMINATED BOARDS. — Ashdowns, Ltd., St. Helens, Lancs, have issued a loose-leaf folder containing the various specifications of their "Ashlam" synthetic resin-bonded laminates. The boards are based on paper, cotton cloth, asbestos or glass fabric. Of great interest is a silicone-bonded glass fabric laminate which is said to withstand temperatures of 250 degrees C. continuous running, this high thermal resistance being combined with excellent electrical properties.

"TENITE" INJECTION MOULDING.—A new edition of the Tennessee Eastman Corp. guide to the injection moulding of "Tenite" cellulose acetate and cellulose acetate-butyrate plastics has been published. Different sections deal in detail with choice of material, product and mould design, machining, cementing and finishing. To illustrate principles of mould construction, eight designs are shown in detail. A chart tabulating possible moulding difficulties with suggested causes and recommended solutions is also given. Copies of this publication may be obtained from Kodak, Ltd., Wealdstone, Harrow, Middx.

CONTINUOUS BOARD MANUFACTURE.—Mr. W. Fischbein, managing director of the British Artificial Resin Co., Ltd., London, recently addressed a conference on "Wallboard from Waste," in Cambridge, Mass., U.S.A. He described the process developed by his company for producing resin-bonded building board from sawdust, as featured in "Plastics," December, 1948. He stated that several of the machines are in the course of manufacture and are expected to be in operation shortly in the United States.

RESINOUS CHEMICALS, LTD.—For some considerable time past the Raw Materials Division of British Paints, Ltd., controlling the sales of synthetic resins, synthetic drying oils, fine colours, moulding powders, synthetic laminating and bonding resins and varnish media has been operating as a separate unit within the organization. The reason for such separation is obvious.

In view of the vast rapid progress which this unit has made and to enable it to give even better service to existing customers, whilst at the same time developing its resources to the fullest possible extent, it has been decided that as from January 1, 1950, it will operate quite independently under the title of Resinous Chemicals, Ltd., with headquarters at Blaydon, County Durham. The directors, Mr. J. O. Dodd, Mr. J. A. Allday and Mr. H. R. Brown, have a long association with the paint and allied trades in general, and raw materials in particular. Service to customers will continue in the same capable hands as before, as all trained personnel and staff are to be transferred to the new organization.

BRITISH INDUSTRIAL PLASTICS, LTD.—The British Shareholders Trust announce that they have recently placed privately £250,000 of 4½ per cent. Unsecured Notes 1955-59 of British Industrial Plastics, Ltd. Hitherto the company's capital has been represented by £580,000 of ordinary 2s. shares and £14,800 of 10 per cent. tax-free preference shares of the same denomination.

FRASER AND GLASS, LTD.—Following a year marked by a steady increase in their custom moulding business, Fraser and Glass, Ltd., have acquired additional premises of approximately 15,000 sq. ft. near their main factory in North London. Mr. F. A. Gardiner, who until recently was works manager with O. and M. Kleemann, Ltd., at their Aycliffe, County Durham, works, has joined Fraser and Glass, Ltd., in the same capacity. It is also announced that Mr. J. M. Cheesbrough has been appointed sales manager.

BX PLASTICS, LTD., announce that Mr. R. Maitland has been appointed sales director.

BRITISH INDUSTRIAL PLASTICS, LTD.—Mr. Harold A. Brooks has joined the staff of B.I.P. as assistant to the managing director, for whom he will undertake special duties.

E.V.B. PLASTICS, LTD., Brighton Road, Salfords, near Redhill, Surrey, inform us that their Mr. and Mrs. Barnes will be showing plastic toy lines at the Chicago Fair, 1950. They would like it known that if any manufacturer has an original line which has dollar earning possibilities, a selected number will gladly be taken by Mr. Barnes. Contact should be made direct to E.V.B. Plastics, Ltd. (Horley 1067).

RUBBER IMPROVEMENT, LTD., Leonex Works, Hythe Road, Willesden, N.W.10, recently issued an attractive full colour booklet called "The Gateway to Better Plastics" which gives a general introduction to the properties, manufacture and uses of p.v.c. plastics. "Rilcom" p.v.c. compounded by Rubber Improvement, Ltd., in different grades and colours for calendering, extruding, cable insulation, etc., as well as "Rilotex" p.v.c. pastes for spreading, dipping and moulding, are discussed in greater detail.

MR. S. H. PINNER, of BX Plastics, Ltd., has been awarded an E.C.A. scholarship for the study of technology in the United States. He has commenced a two-year course in plastics technology at the Polytechnic Institute, Brooklyn.

RICHARD DALEMAN, LTD., 325-327, Latimer Road, London, W.10, inform us that they have taken over the manufacture of "Evolite" "Perspex" tubes and cylinders and are now in full production. These tubes have many applications in industry, such as pipelines in breweries, dairies, etc., research laboratories and hospitals.

AIRFIX PRODUCTS, LTD., was registered on January 2, 1950, with an authorized share capital of £50,000. The directors are N. Kove, C. Kove and M. Prussack. The company is to continue the business hitherto conducted under the same name.

BLUEMEL BROS., LTD., regret to announce the death of their director, Mr. R. E. Bluemel, on December 31 last, while convalescing after an illness lasting several months. The late Mr. Bluemel, who was in his 56th year, was the son of Ernest Bluemel, one of the founders of C. W. Bluemel and Bros.

HELLERMANN ELECTRIC, LTD.—Upon the occasion of the official opening of the Crawley Industrial Estate on January 25, Mr. J. Bowthorpe, managing director, Hellermann Electric, Ltd., was presented to H.R.H. Princess Elizabeth.

MR. E. J. WILKINS has retired from the editorship of "British Plastics," and has been succeeded by Mr. Philip Morgan.

Forthcoming Meetings

Feb. 10.—"Polythene." Maldwyn Jones (Imperial Chemical Industries, Ltd.). Plastics Institute, North-Western Section. Engineers' Club, Albert Square, Manchester, 2.

Feb. 14.—"Recent Developments in Ion-Exchange Resins." Dr. K. W. Pepper (Chemical Research Laboratory, D.S.I.R.). S.C.I Plastics and Polymer group. Royal Society of Tropical Medicine. 26, Portland Place, London. W.1. 6.30 p.m.

Feb. 15.—"Scientific aspects of polymer formation in the thermosetting field." Dr. N. J. L. Megson (Ministry of Supply). Plastics Institute, Southern Section, University College, Southampton. 7.45 p.m.

Feb. 17.—"Laminated Plastics." J. M. Fleming. Plastics Institute, Midlands Section. James Watt Memorial Institute, Great Charles Street, Birmingham. 6.30 p.m.

Feb. 17.—Title of paper to be arranged. Speaker: Prof. C. E. H. Bawn (University of Liverpool, late lecturer in Chemistry at University of Bristol). Plastics Institute, Western Section. Gloucester.

Feb. 22.—"Advances in Moulding Technique" A. A. Tomkins (Joseph Lucas, Ltd.). Plastics Institute, London Section. Waldorf Hotel, Aldwych, London, W.C.2. 6.30 p.m.

Feb. 28.—"Injection Moulding." E. M. Elliott (Imperial Chemical Industries, Ltd., Plastics Division). Plastics Institute, North-Eastern Section, Neville Hall, Newcastle-on-Tyne. 6.30 p.m.

March 2.—"Plastics and Corrosion." Dr. Harry Barron. Plastics Institute, Western Section, Bristol.

March 8.—Problem Night. Plastics Institute, Yorkshire Section. St. Mark's House, 186, Woodhouse Lane, Leeds. 7 p.m.

March 8.—"Some recent trends in Thermoplastic Materials." Maldwyn Jones. Plastics Institute, Scottish Section.

Successful Designing for Plastics Moulding—VII

By W. M. HALLIDAY

Having satisfactorily settled the closely inter-dependent factors of material, functionality, and method of manufacture, the designer may then fill in the final details of component design. These details will largely have to be decided in the light of the requirements involved in mould design, manufacture, and use, and to some extent to suit the characteristics of the particular moulding technique to be employed.

Certain accepted and proved principles of mould designing have been developed from practical experience, as producing the best and most economical practical moulding results. The final details of component design should be in conformity with these principles.

PREVIOUS articles published in this series have described in detail the numerous general but inter-dependent factors which have to be considered when designing a plastics component as a preliminary to laying down the basic and final features it will eventually possess.

These important factors, as has been shown earlier, are applicable alike whichever form of moulding manufacture is selected. They will nearly always comprise all of the following : choice of material ; precise functions to be performed by the finished article in respect of working conditions ; selection of the most suitable method of manufacture ; strength or similar mechanical properties, which it must have to fulfil service requirements ; and general suitability as far as shape and configuration is concerned, so far evolved, to conform with the requirements of the manufacturing process chosen.

The manner in which these factors are inter-related will be appreciated from some of the preceding discussions on these points. For example, the kind of material will be controlled in large measure by the working conditions to which the part has to be exposed and the particular physical qualities which must therefore be obtained.

The permissible moulding procedure to be followed will, in turn, be conditioned by the type of material selected. Indirectly, the choice of material will determine the rate of production.

If the component has to be made as a compression moulding, the length of curing and the time required to complete a cycle of operations on the mould will be controlled by the material chosen. If the part has to be made as an injection moulding, the time required for a cycle of operations will be conditioned in a measure by the plasticizing time of the material and the speed with which the mould may be worked.

The functionality requirements of the component will not only tend to determine the material which may be used, but also the broad features of its shape and design form. In turn, these factors will influence mould design and usage in a variety of ways, some of which will be more fully explained later in this article.

The method of manufacture and the type of mould usable will exert an influence upon the cost of the finished components, since the rate of production may be controlled greatly by these factors. Mould design also will be affected to a considerable extent.

From this it will be appreciated how closely and intimately bound up all these various factors are with each other. In the case of a component of very complex design form, or intricate shape, required to meet difficult service conditions, the task of carefully balancing out these factors to obtain economical moulding and satisfactory product will become a skilled task. Its solution will demand considerable knowledge of moulding processes and mould designing. It is, in fact, a specialist function.

Final Design for a Component

Having satisfactorily disposed of these preliminary but essential considerations, the component designer may proceed to elucidate and fill in the remaining detailed design forms.

Many of these will be determined very closely by the type of moulding tool to be employed, or the need for its most economical manufacture, or the cost level of such a tool which the job will bear. This latter is extremely important, because in so many moulding propositions mould costs loom very large in the order of points to be considered.

Whilst practically any complicated shape can be reproduced in a moulding tool, providing there is no overriding restriction upon its cost, or the time required to manufacture it, it has to be borne in mind that in practice most moulds have to be designed and manufactured strictly within a price range. To render this practicable, it is often highly necessary to adapt, modify or simplify the proposed design form of a component very substantially before commencing its manufacture.

Usually such economies will best be accomplished if the designer, whilst formulating the final details of the shape, form and sizes for the part, adheres closely to the now well-recognized forms and design features which have been found by practice to lend themselves to simple and economical reproduction both in respect of mould constructions and during subsequent actual moulding operations.

It is the purpose of this and ensuing sections of this series to consider in detail these preferable forms, and to explain the underlying practical reasons leading to their selection and adoption, in contrast to other forms, which on a purely surface view might appear to offer greater practicality to those not intimately acquainted with the requirements of mould manufacture and usage.

The method to be followed will be to select each particular kind of design feature, to show both the preferred and undesirable forms it may take. In this simple way both the pitfalls to be avoided in the use of unsuitable design forms and the advantages gained by adopting preferred forms will be clearly illustrated.

Requirements in this connection will, of course, be very similar for both compression and injection moulds, because, as already outlined in preceding articles, in each case the mould has to be made in a split form. However, there are numerous minor differences worthy of note. In the examples to be dealt with, and illustrated later, these differences will be carefully explained and distinguished.

Before proceeding with the description of these various preferred design forms, etc., it will be advisable to discuss a number of general features applicable alike to both compression and injection moulded articles, and which very often have a good deal of influence upon the features which may be embodied in component design and the mould construction.

(1) Material Shrinkage

Perhaps the chief of these general factors is that of material shrinkage occurring when the finished moulded component has been taken from the mould and allowed to cool to atmospheric temperature. Practically all mouldable plastics materials are subject to this variation. This means that all plastics mouldings will be *dimensionally smaller* than the mould cavity from which they have been reproduced.

The amount of shrinkage may vary considerably according to the kind of material used. Generally it is greater with thermo-setting materials compression moulded, chiefly owing to the fact that the tools required with this method of manufacture have to be worked at much higher temperatures than injection moulding tools, and consequently contraction of material takes place over a greater temperature range.

When certain dimensions of a moulded article have to be maintained within very close limits of variation, it will, of course, be very important for the designer to determine the extent of shrinkage occurring by reference to actual mouldings taken at a test run of the tool.

For this purpose the cavity formation of the mould would purposely be left smaller in size than that indicated by the empirical shrinkage value attaching to the material. Cores would accordingly be left slightly larger. By adopting this practice the mould engineer is then enabled to make a test run on the new mould, and to measure up very carefully the essential dimensions on these samples, thereby determining exactly what further amount of material has to be removed from cavity walls and sides of cores to obtain the required dimensions on the part.

This practice is habitually followed with both compression and injection type moulds when close tolerances have to be met on dimensions.

(2) Rate of Shrinkage

The rate of shrinkage may also differ considerably according to material, and changes in certain conditions over subsequent mouldings produced in the same material and from the same mould. It may often be found, for instance, that where components have to be successively reproduced from the same mould, but in different colours, variations in the shrinkage rate occur.

Differences in working conditions surrounding the use and manipulation of the mould may produce differences in shrinkage rate. Likewise, the shape of the moulding itself may be of such a character to cause unequalized shrinkage. This will chiefly occur if the part possesses extensive thick and thin sections, sudden interruptions in wall thickness, extensive coring, deep undercuts and like portions.

(3) Effects of Shrinkage

Shrinkage occurring with thermo-setting plastic materials may also entail some difficulties when extracting the finished component, due to the grip obtained by the contracting part upon core plugs, etc. To overcome this, sufficient side taper must be imparted to the walls of cores. Any waviness or scratches would still further retard extraction.

If the wall section is of slender proportions at certain points, cracking might easily occur by reason of strains arising from shrinkage. This will be particularly the case if such thin portions are joined to much thicker sections, or if metallic inserts are situated in the thin wall sections. Unequalized shrinkage pressures will be created, which will be arrested by the insert so resulting in crack formation.

Heavy masses of material closely and suddenly joined to thin sections will also create unequalized rates and extent of contraction. The thin section will cool first, and will tend to be stretched by the contraction still continuing in the thick sections. The tendency will be for the shrinking heavy masses to draw material from the weaker and thinner sections. Shrinkage of the surface may also result from the same cause, and the moulded article would exhibit one or more unsightly depressions on the surface.

Hollow moulded articles, such as cups, boxes and like shapes—especially if the wall section is non-uniform in thickness—may be severely distorted out of correct shape, after moulding by the stresses arising from unequalized shrinkage.

Shrinkage on a component occurring within the mould prior to ejection may also produce harmful effects upon core plugs or other members of the tool. This will be very apt to arise if such cores are of very small diameter, and project for greater distances into the cavity area. If blind holes have to be moulded, entailing an unsupported core plug, this tendency will be still further increased.

The solution for this undesirable objection is to mount core plugs in the mould so that they are supported at *each end*, thus forming a hole clean through the moulded article. The amount of projection of an unsupported core plug should not exceed four to six times its diameter at the smallest diameter. Core plugs which can be supported at each side of the cavity may, of course, be made much longer. Examples of both kinds of core plug design will be shown later, to illustrate preferred forms.

Shrinkage occurring with thermo-plastic materials for injection moulding may also cause somewhat similar troubles. Thus surface sinks, dimpling or undulations may be caused. Particularly will such surface defects be apt to be located at the junction of thick and thin wall sections. Unequalized shrinkage pressure will therefore arise, the heavy sections cooling last will tend to draw material from the much cooler and weaker thinner sections, resulting in sinks being formed on surfaces opposite to the heavier portions of the moulded article.

Troubles during ejection of the component from injection moulds may also arise, due to the contraction of the component, on to core plugs. This undesirable feature is not likely to be as severe, however, as that occurring with compression moulds, for several reasons.

In the first place, injection moulds are operated at a much lower working temperature; secondly, injection is mechanically performed and the pressure required for this operation can thus be much more evenly distributed over the affected area. Ejection is usually accomplished very quickly after the actual injection stage, so that a minimum amount of time is allowed to elapse before removing the parts from the mould cores. This can usually be performed even though the injection mould may have a large number of cavities.

This facility should be contrasted with what happens in connection, say, with a manually actuated compression mould of the multiple-cavity type. With this latter type of tool, after cure, the mould will be opened, and the components may have to be extracted separately by hand, from their respective cores. By the time the last moulding has been reached a considerable time will have elapsed, during which contraction will still be taking place.

Shrinkage effects are likely to be particularly important in the case of components having moulded-in thread portions, and which require to be unscrewed from core plugs during ejection. Unless this is performed mechanically, as is often done with injection moulds, by the way, considerable time may be occupied in removing all components from a multiple impression tool.

Threads may, therefore, easily be damaged, especially if these are formed with perfectly sharp corners at crest and root, an undesirable type of thread formation, which should be avoided as far as possible. Such difficulties will arise in their most troublesome form with manual-type compression moulds where each component has to be unscrewed by hand.

(4) Allowance for Mould Contraction

In addition to the normal allowances provided to overcome dimensional deductions attendant upon the contraction of the material upon cooling, it will often be necessary for the mould designer to make an extra allowance to cover the shrinkage of the mould itself.

Again, this will generally be associated with compression type moulds, and will largely be conditioned by the working temperatures used in conjunction with the production of a component having precision dimensional tolerance.

(5) Post-moulding Shrinkage

Many plastic materials have a tendency to shrink a slight amount, over a prolonged period after leaving the mould, especially if the component is exposed to hot working temperatures.

With compression mouldings in urea, for example, it very often happens that the mould designer has to make provision, by slight increase in cavity dimensions, to counteract the tendency. Certain thermo-plastics also have the same tendency, this chiefly arising because of the loss of plasticizing agents. Such post-moulding shrinkage may also produce slight surface blemishes and defects on the component, as well as loss of dimension.

(To be continued.)

PATENT REVIEW

The following abstracts have been made from specifications at the Patent Office, with the permission of the Controller of H.M. Stationery Office. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 2/- each.

B.P. 626,167. Appl. 16.7.47. Acc. 2.8.49.
Production of resinous compositions of matter and the products resulting therefrom. L. R. Anthony, E. M. Evans and R. W. H. Wicking. To: British Resin Products, Ltd.
Refers to urea-formaldehyde resins.

B.P. 626,877. Appl. 2.10.46. Acc. 22.7.49.
A process of refining intensively cracked gas oil and producing heating oil and polymerized products therefrom. To: Standard Oil Development Co.

B.P. 626,909. Appl. 7.1.47. Conv. (U.S.A.) 21.1.46. Acc. 22.7.49.
Manufacture of siloxane resins. W. R. Collings, H. N. Fenn and H. J. Fletcher. To: Dow Corning Corp.

B.P. 627,136. Appl. 15.5.47. Conv. (U.S.A.) 18.5.46. Acc. 29.7.49.
Manufacture of organo siloxane polymers. To: The Dow Chemical Co.

B.P. 627,301. Appl. 12.7.46. Conv. (Switzerland) 17.7.45. Acc. 5.8.49.
Manufacture of a hardenable binding agent in a stable aqueous form. To: Ciba, Ltd.
Binding agents produced from casein brought into solution with the aid of urea or thiourea and formaldehyde.

B.P. 627,311. Appl. 19.9.46. Acc. 5.8.49.
Manufacture of brands, sheets and other similar mouldable products from vegetable fibrous materials. H. R. Hanbury. To: Syntas, Ltd.

B.P. 627,376. Appl. 25.7.47. Conv. (U.S.A.) 25.7.46. Acc. 8.8.49.
Production of chlorinated polythene. To: E. I. du Pont de Nemours and Co.

B.P. 627,440. Appl. 25.4.47, 26.7.47. Acc. 9.8.49.
Apparatus for use in coating surfaces with plastic and other semi-liquid compositions. A. H. Hawes. Spray Gun.

B.P. 627,457. Appl. 25.5.47. Conv. (U.S.A.) 25.7.46. Acc. 9.8.49.
Chlorinated polythene compositions. To. E. I. du Pont de Nemours and Co.
Chlorinated polythene composition comprising soluble chlorinated polythene, an oxide of lead and an aromatic peracid or peroxide.

B.P. 627,756. Appl. 13.2.47. Conv. (U.S.A.) 2.3.46. Acc. 16.8.49.
Furfurvl alcohol resin. P. L. McWorther, Jr. To: Haveg Corp.

B.P. 627,800. Appl. 20.6.47. Conv. (U.S.A.) 8.7.46. Acc. 16.8.49.
Manufacture of new organofluoro-siloxane products. To: The Dow Chemical Co.

B.P. 627,920. Appl. 30.7.47. Conv. (U.S.A.) 2.11.44. Acc. 18.8.49.
Sulphonated phenolic condensation products. To: The Dow Chemical Co.

B.P. 627,925. Appl. 7.8.47. Conv. (U.S.A.) 3.5.49. Acc. 18.8.49.
Solution of a rotenone containing phenol-aldehyde insecticide. To: The Harvel Corp.

B.P. 627,930. Appl. 11.8.47. Acc. 18.8.49.
Stabilization of asym-dichloroethylene. F. W. Kirkbridge. To: I.C.I., Ltd.
Refers to the use of isopropylamine as stabilizator.

B.P. 628,250. Appl. 21.12.45. Conv. (U.S.A.) 28.12.44. Acc. 25.8.49.
Production of melamine. To: E. I. Du Pont de Nemours and Co.
Production of melamine from urea by pyrolysis, by subjecting the pyrolysate to the action of water at elevated temperatures and pressures subsequently removing the melamine from the resulting aqueous solution.

B.P. 628,466. Appl. 2.5.46. Conv. (Italy) 25.2.43. Acc. 30.8.49.
Coated threads or the like of synthetic linear polyamide resin. To: S.p.A. Lavorazione Materie Plastiche.

B.P. 629,111. Appl. 12.7.46. Conv. (Switzerland) 13.7.45. Acc. 13.9.49.
Method of adhesively uniting materials especially metals and adhesives therefor. To Ciba, Ltd.

B.P. 629,481. Appl. 27.2.47. Conv. (U.S.A.) 7.10.42. Acc. 21.9.49.
Production of resinous materials. To: Harvel Research Corp.
Condensation of furfuraldehyde and a ketone having an hydrogen atom on an alpha carbon atom under alkaline conditions and subsequently condensing the resulting product with formaldehyde under acidic conditions.

B.P. 629,486. App. 10.6.47. Conv. (U.S.A.) 11.6.46. Acc. 21.9.49.
Preparation of dimethyl silicone gums. To: The British Thomson-Houston Co., Ltd.

B.P. 629,490. Appl. 13.8.47. Acc. 21.9.49.
Manufacture of oil modified alkyd resins. D. Atherton, J. K. Lovell. To: I.C.I., Ltd.

B.P. 629,642. Appl. 10.6.47. Conv. (U.S.A.) 11.6.46. Acc. 23.9.49.
Methods of preparing dimethyl silicone gums. To: British Thomson-Houston Co., Ltd.

B.P. 629,787. Appl. 28.11.47. Patent of addition to No. 626,145. Conv. (U.S.A.) 7.12.46. Acc. 28.9.49.
Coating compositions containing synthetic resins. To: Westinghouse Electric International Co.
Preparation of resin solutions from polyester amide resinous composition in a mixed solvent which comprises a true solvent for the resins and an organic non solvent diluent (ethanol and xylene).

B.P. 630,103. Appl. 16.7.47. Conv. (U.S.A.) 14.7.45, 23.2.46. Acc. 5.10.49.
Preparation of compounds of the cyclopentanodimethylpolyhydrophenanthrene series. To: Merck and Co., Inc.

B.P. 630,632. Appl. 21.5.47. Conv. (U.S.A.) 21.5.46. Acc. 18.10.49.
New polymerizable compositions and polymers thereof. To: E. I. du Pont de Nemours and Co.
Relates to bifunctional methacrylates.

B.P. 630,647. Appl. 14.7.47. Conv. (Switzerland) 19.7.46. Acc. 18.10.49.
Method of adhesively uniting materials especially metals, and adhesives therefor. To: Ciba, Ltd.
Refers to the use of an ethylene oxide derivative of 4 : 4′-dioxydiphenyl-dimethyl methane as resinous binder for metals to be united.

B.P. 630,653. Appl. 1.8.47. Acc. 18.10.49.
An improved optical system made from synthetic resin. W. A. Greenwood and W. Liddell. To: I.C.I., Ltd.
Optical systems for television projection.

B.P. 630,736. Appl. 6.9.46. Conv. (Netherlands) 24.11.42. Acc. 20.10.49.
Improvements in or relating to the manufacture of mouldings. To: N. V. Philips Gloeilampenfabrieken.

B.P. 630,738. Appl. 30.5.47. Conv. (U.S.A.) 1.6.46. Acc. 20.10.49.
High frequency dielectric heating apparatus. To: The British Thomson-Houston Co., Ltd.

B.P. 630,883. Appl. 29.11.46. Conv. (U.S.A.) 30.11.45. Acc. 24.10.49.
Silicone Compositions. To: The British Thomson-Houston Co., Ltd.
Heat curable silicone composition comprising a dimethyl silicone gum and mercury oxide.

B.P. 630,974. Appl. 24.4.47. Conv. (U.S.A.) 4.5.46. Acc. 24.10.49.
Alkyd Resins. To: Bakelite Corp.

B.P. 630,951. Appl. 26.8.47. Acc. 24.10.49.
Manufacture of Organo Silicon Esters. To: Dow Corning Corp.

B.P. 630,952. Appl. 26.8.47. Acc. 24.10.49.
Manufacture of Organo Silicon Alcohols. To: Dow Corning Corp.

B.P. 631,018. Appl. 3.7.47. Conv. (U.S.A.) 29.10.42. Acc. 25.10.49.
Organo-dihalogensiloxanes. To: British Thomson-Houston Co., Ltd.

B.P. 631,049. Appl. 26.8.47. Acc. 26.10.49.
Manufacture of organo silicon alcohols. To: Dow Corning Corp.

B.P. 631,073. Appl. 20.10.47. Acc. 26.10.49.
A process for dyeing nylon. D. N. Sharing. To: I.C.I., Ltd.
Dyeing of nylon textiles with dyestuffs which can be after-chromed.

B.P. 631,200. Appl. 24.2.47. Conv. 18.12.47. Acc. 28.10.49.
Condensation products of ureides and formaldehyde. H. Jones and J. K. Hiken. To: The Geigy Co., Ltd.
Condensation of trichlorethylidene diureide and formaldehyde.

B.P. 631,225. Appl. 30.10.47. Conv. (U.S.A.) 30.10.46. Acc. 28.10.49.
Polymerization of ethylenically unsaturated compounds. To: E. I. du Pont de Nemours and Co.
Refers to the polymerization of acrylonitrile.

B.P. 631,260. Appl. 26.2.47. Conv. (Sweden) 10.5.46. Acc. 31.10.49.
Improved manufacture of thick foils of regenerated cellulose and cellulose derivatives. To: Ko-Operativa Förbundet Förenging.

B.P. 631,272. Appl. 30.5.47. Conv. (U.S.A.) 23.8.46. Acc. 31.10.49.
Recovery of polymeric materials. To: Standard Oil Development Co.

B.P. 631,294. Appl. 26.9.47. Conv. (U.S.). 20.3.49. Acc. 31.10.49.
A container and method of making the same. I. Gurwick. To: Shellman Products Corp.
Cemented cellophane containers.

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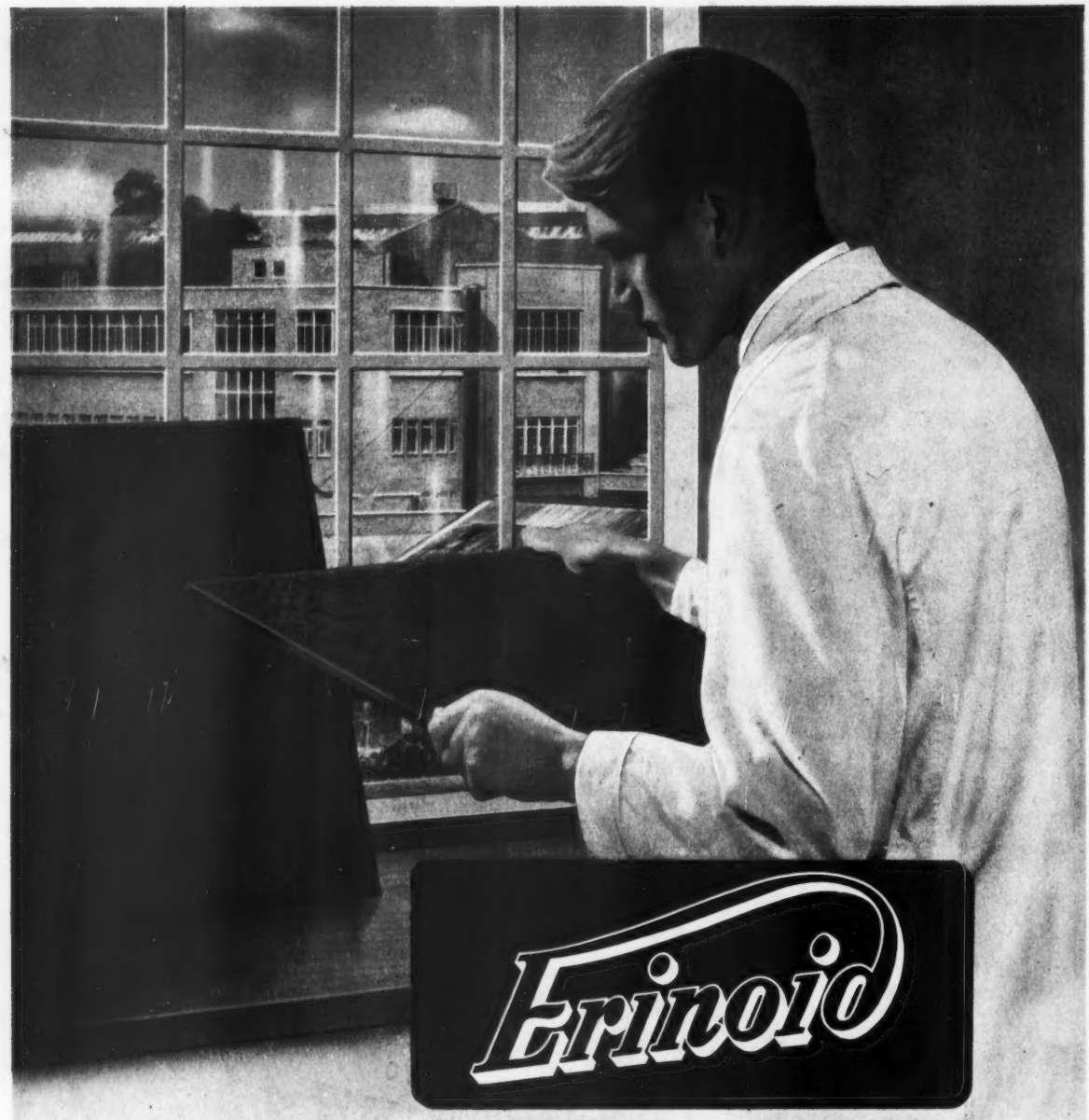

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